Welding Engineer

MARCH, 1961
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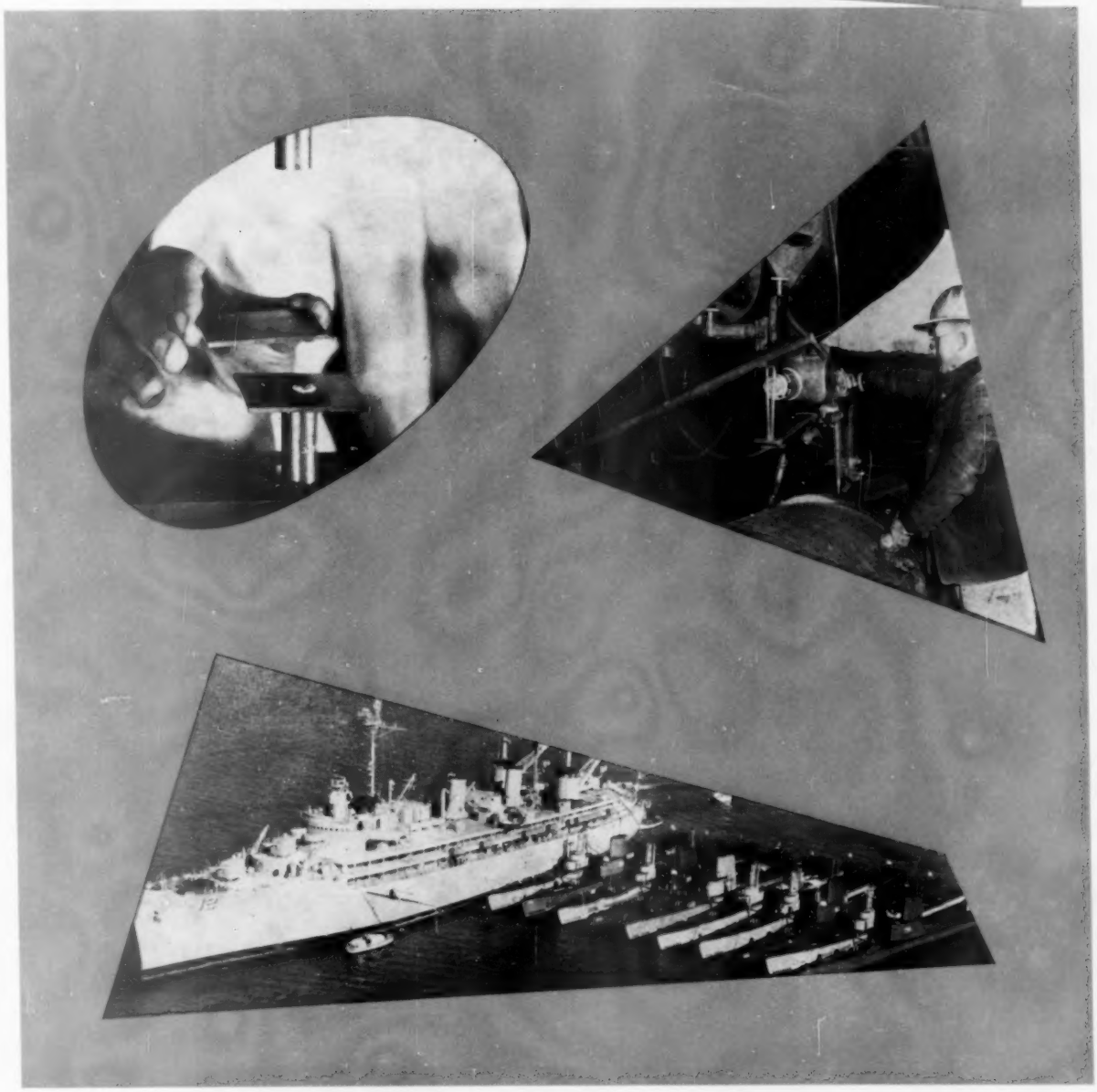
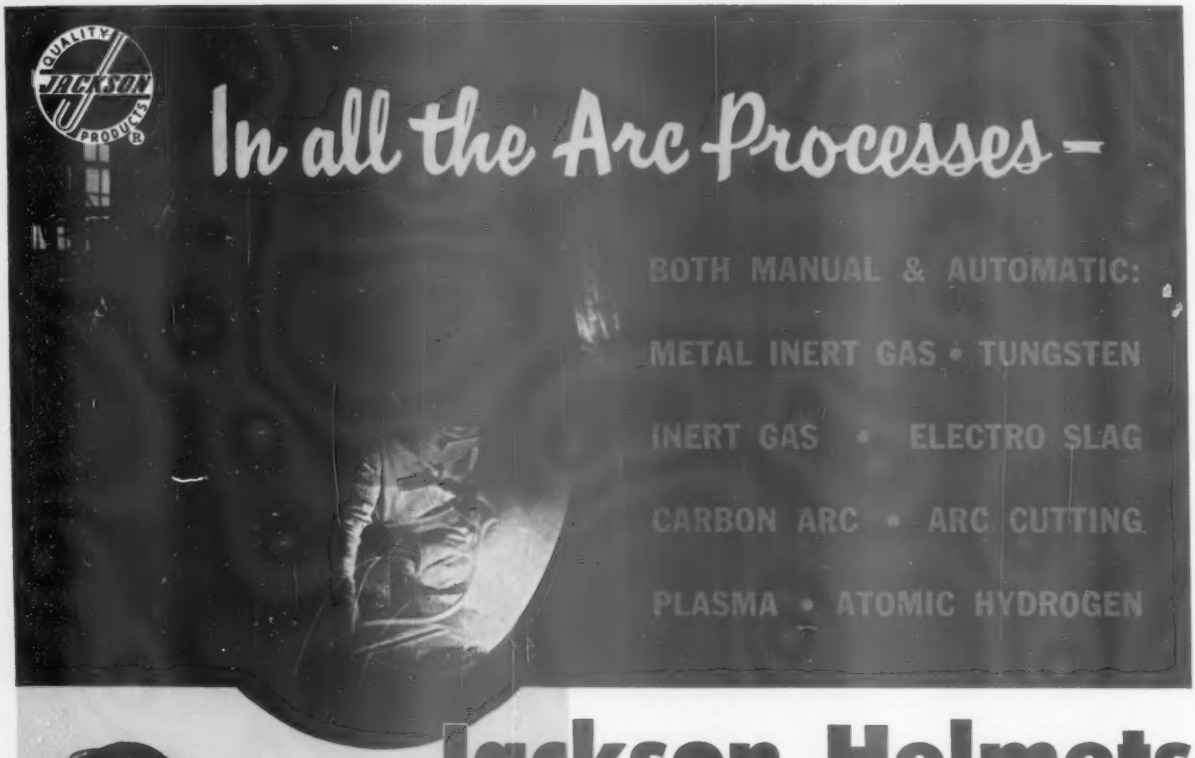


Top left: **Fiber metal resistance welding, page 27**

Top right: **Island-mine pilings submerged-arc welded, page 30**

Bottom: **Navy repair welding enters nuclear age, page 32**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Curved Shell Fiber Glass
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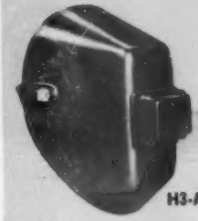
Shown: handy plastic lift-front type.

H2-A

Curved Shell Vulcanized Fiber
With choice of three lens holders.
Shown: front-loading metal holder.

H-10A



Narrow Shell Fiber Glass
With choice of three lens holders.
Shown: non-conductive plastic holder.

H3-AP

Straight Shell Vulcanized Fiber
With choice of three lens holders.
Shown: non-conductive plastic holder.

H-30AP

Straight Shell Fiber Glass
With choice of three lens holders.
Shown: handy lift-front type.

H9-A

Left: Five different handshields are available.
Right: All Jackson Helmets may be bought in combination with any of three Jackson safety caps. Great comfort, greater safety.

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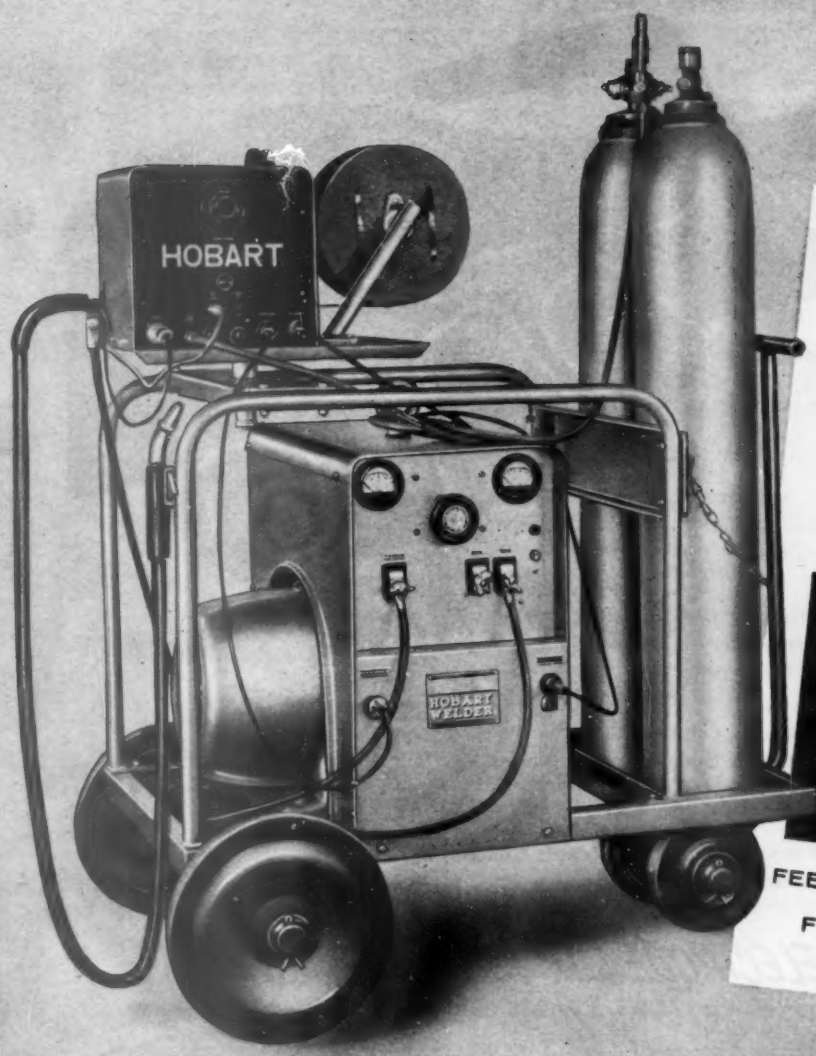

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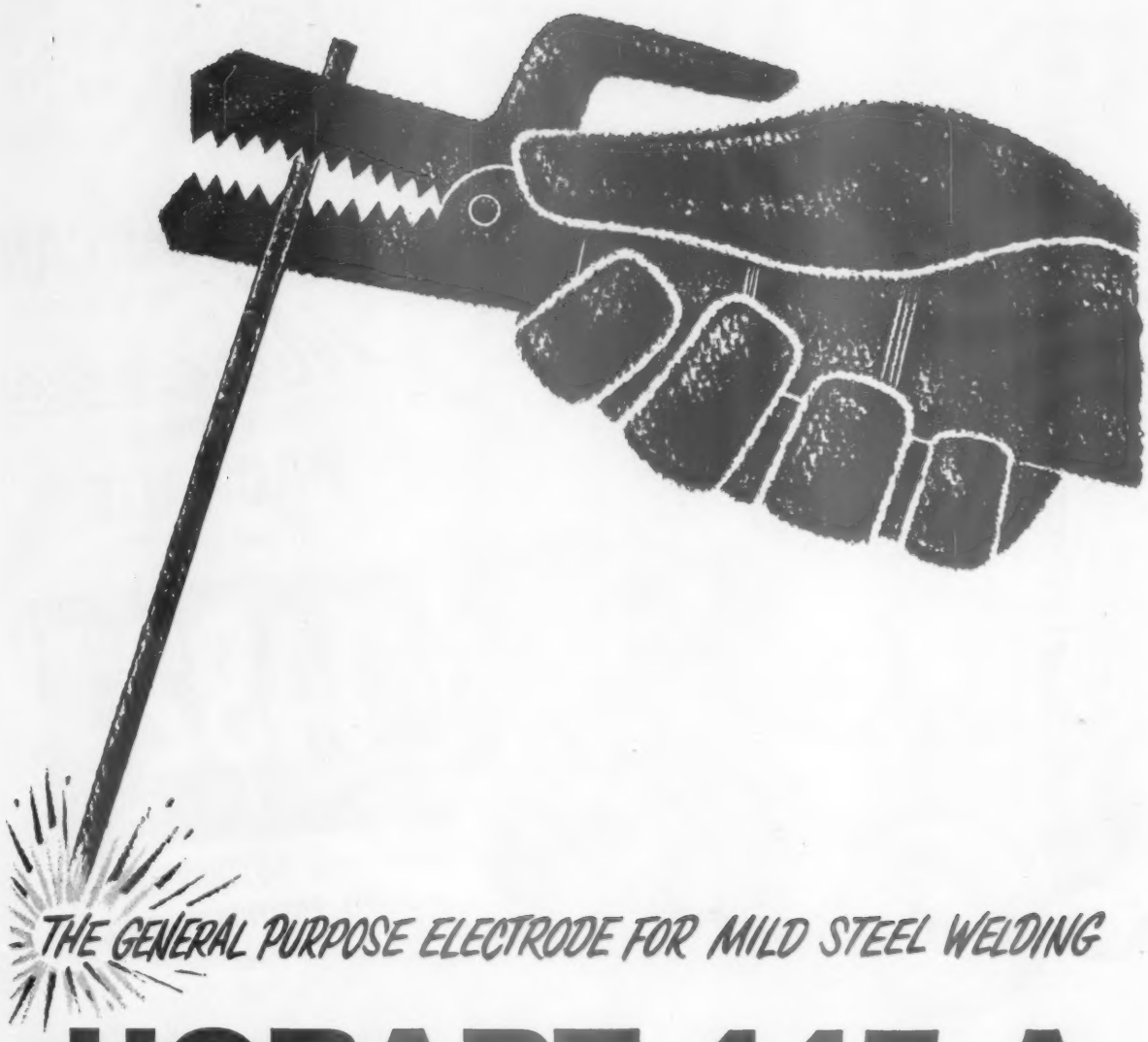

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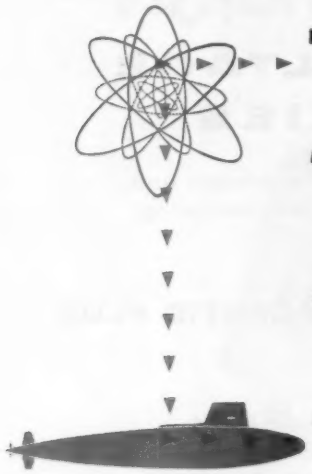
VOL. 46—No. 3

Welding Engineer

The magazine of joining and severing of materials

This is welding: March, 1961



Nuclear piping demands revised welding procedures 25

►►►►New metals and alloys are being developed to meet nuclear piping's expanded temperatures and pressures. Thus, says **R. H. Hoefler**, normal welding procedure qualification is no longer adequate.

Metal fibers promise more efficient resistance welding 27

Application of a felt-like fiber metal mat has provided greater efficiency in both resistance welding and brazing, as detailed by author **Harry Schwartzbart.**

★ (For a reprint of this article, circle number 250.)

Steel island is $30 million sulphur mine 30

In the Gulf of Mexico, a submerged-arc and Tig welded steel island mine was built to develop one of the largest sulphur domes ever discovered, as reported by **T. Anderson** and **E. L. Trimble.**

Navy welding school steps into the nuclear age 32

►►The Navy's "big-step-up" from conventional ship construction created a need in its at-sea repair forces. **James Hurlburt** describes the steps being taken to meet this need.

Proper welding saves thousands of dollars for Ford 34

Welding has salvaged much equipment that might otherwise have been scrapped. At Ford's Steel Division, Editor **F. T. Tancula** encountered a wide range of such repair jobs.

Production line speeds heavy equipment fabrication 38

Welding positioners and a self-fluxing semiautomatic CO_2 welding process have combined to increase production efficiency for this road-building equipment manufacturer.

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3

THE HOLDER that *Can't Get Hot!*

the MODEL 600 "*Shortstub*"

Pats. Pend.

DESIGNED WITH PRIMARILY ONE PURPOSE IN MIND

- - to completely eliminate electrode holder heating - and the time and money lost by this problem . . . if you have hot holder problems you already recognize the dollars it costs in down time and in electrode waste.

NO WATER COOLING REQUIRED

The operator's hand is kept cool in two ways. One, the cable is brought directly to within a fraction of an inch of the electrode and does not pass through the handle of the holder. There is nothing in the handle that can get hot — it is completely empty. Two, the operator's hand is protected from the heat radiated from the arc and work-piece by a light-weight aluminum guard. The Model 600 "Shortstub" contains all of the many advantages of the standard Model #4 and #6 "Shortstub" electrode holders, such as the feature which reduces stub losses to the lowest possible minimum, the low cost renewable head feature and 100% safety insulation. The Model 600 "Shortstub" is not intended to replace every holder in your shop — but to be used only on those applications where holder heating is a problem.

SPECIFICATIONS AND PRICES

Capacity: 600 Amps, 100% Duty Cycle Length: 11" Weight: 28 oz.

1 to 11 . . . . . $15.70 each 12 and up . . . . . $14.70 each

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BRIDGEPORT BRASS COMPANY
Specialists in Metals from Aluminum to Zirconium

ARO Spot Welder Corp. has established its new headquarters (left) at 66-10 Woodside Ave., Woodside, N. Y. Inside the new service, sales and warehouse building (right), Frank Furth watches as Max Osborn checks a new filing cabinet. Vice Presidents Furth and Osborn are in charge of the facility.

Aro opens 6,000-sq-ft facility in New York City area

Aro portable spot welders will now be sold through sales, service and warehouse facilities established at 66-10 Woodside Ave., Woodside 77, N. Y. by the parent French firm.

This American headquarters for the Aro Spot Welder Corp. includes 6,000-sq-ft of space complete with working laboratory and demonstration area.

In addition, the new facility is equipped to test weld samples with tensile as well as pressure-gage equipment. Repair work can be done with one or two-day service and customers and distributors can bring samples for welding.

Active management of the new facility is in the hands of two vice presidents, Max Osborn and Frank Furth.

Furth was formerly vice president of Guthery Machine Tool Corp., Long Island City, N. Y.

The new headquarters is located a few minutes from midtown Manhattan.

AWS Wichita show to feature exhibits

Clinic-type demonstrations and operational instructions are expected to predominate at the AWS Wichita Welding Show on March 24 and 25.

The purpose of the show is to bring the latest in welding to Kansas. Live displays will be featured.

Inco opens new welding lab

A new welding laboratory has been placed in operation at Huntington Alloy Products Div., The International Nickel Co., Inc., Huntington, West Va.

Construction of the modern 4,000-sq-ft facility was completed last month and specialized equipment is now being installed.

A major part of the research to be conducted at the new $200,000 laboratory will be in the nuclear power field for both industry and national defense.

New oxygen plant supplies Bethlehem

Air Reduction Sales Co., New York City, has signed a contract to construct and operate a tonnage oxygen plant for Bethlehem Steel Co.'s blast furnaces at Johnstown, Pa. (See WELDING ENGINEER, February, p. 30.)

This largest single-column industrial air separation facility is scheduled for completion by September. With a production capacity of 675 tons of oxygen per day, the plant represents an investment in excess of 5 million dollars.

March's Headlines

Hobart offers course on automatic welding

A course in automatic welding for management personnel will be given at the Hobart Technical School, Troy, Ohio, March 20-24 and May 22-26.

Another course on gas shielded arc welding processes will be given April 24-28.

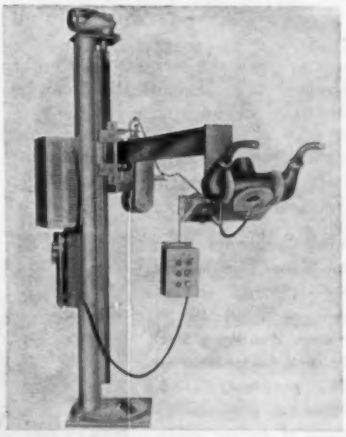
The automatic welding course is designed for companies now using welding, but interested in automatic welding. Registration information can be obtained by contacting Hobart Bros. Technical School, Box DM-168, Troy, Ohio.

Research council plans university conference

The university research committee of Welding Research Council, New York City, will hold its annual conference April 19 at 8 p.m. at the Commodore Hotel, New York City.

To encourage more basic research in welding processes, the committee has planned a two-paper symposium on arc physics research.

Research men from industry, government agencies and universities are invited to attend.



HEADING for the U.S. Atomic Energy Laboratory, Oak Ridge, Tenn., is this heavy duty stationary installation for industrial radiography. The 150-kv unit was made by Picker X-ray Corp., White Plains, N.Y. Special X-ray positioner unit was made by Ransome Co., Scotch Plains, N. J.

100 engineers prepare for Metal Congress

More than 100 metals engineers are preparing papers to be delivered at the 12th Western Metal Congress and Exposition to be held March 20-24 in Los Angeles.

Sessions will be held by ASM, Society for Nondestructive Testing, Metallurgical Society of AIME, Society of Aerospace Materials and Process Engineers and American Society for Testing Materials.

AWS will present five days of 10 technical sessions.

The Congress will be held in the Ambassador Hotel and the Exposition in Pan-Pacific Auditorium. Technical engineers will man the more than 200 displays.

NCG opens Los Angeles office

Office space and a large warehouse are combined in the new one-story Los Angeles headquarters of National Cylinder Gas Division, Chicago.

The new building, located in Lynwood, Cal., is adjacent to an NCG plant which produces industrial and medical gases.

Standard approved for grinding wheels

The American Standards Association has approved standard specifications for shapes and sizes of grinding wheels.

These new standards classify, according to 12 end-use categories, the shapes and sizes of grinding wheels considered standard by industry.

Copies of the new publication of these standard specifications can be obtained at no charge by writing to the Grinding Wheel Institute, 2130 Keith Building, Cleveland 15, Ohio, and requesting ASA B74.2-1960.

SOME of the 300 persons attending the seventh annual Midwest Welding Conference in February at Armour Research Foundation, Chicago, take a break between sessions. Shown registering for the conference (side) are H. L. McNiel, Iowa Mfg. Co., Cedar Rapids, Ia., at left, and G. T. Odom, Northwest Engineering Co., Green Bay, Wis.

AWS plans meeting on missiles

Questions on missile and rocket fabrication will be answered by experts at a 2 p.m. open meeting on April 19 during the 42nd Annual Meeting of AWS.

The symposium-type meeting will be held at the Commodore Hotel, New York City.

Kodak releases film on in-plant movies

A new film depicting ways motion pictures can serve industry is now available on loan from Eastman Kodak Co., Rochester, N. Y.

The 16mm color and sound film, "Movies at work," emphasizes advantages of do-it-yourself productions.

COMING EVENTS

MAR. 20-24: 12th Western Metal Congress, American Society of Metals, Pan-Pacific Auditorium, Los Angeles, Calif.

MAR. 23-25: 37th Spring Meeting, American Machine Tool Distributors Association, Mark Hopkins Hotel, San Francisco.

MAR. 24-25: Welding Show & Exhibit, Wichita Section AWS, Kansas National Guard Armory, Wichita, Kans.

APRIL 6: 4th Annual Distribution Conference, Pennsylvania Gas Association, Tally Ho Inn, Valley Forge, Pa.

APRIL 10-15: International Institute of Welding Meeting, Sheraton-Atlantic Hotel, New York City.

APRIL 17-21: 42nd Annual Convention, AWS, Commodore Hotel, New York City.

APRIL 18-20: AWS Annual Welding Exposition, Coliseum, New York City.

APRIL 24-25: IAA Annual Meeting, Sheraton-Plaza Hotel, Boston.

MAY 8-10: 17th Annual Convention, NWSA, Hotel Commodore, New York City.

MAY 22-25: The Design Engineering Show, Cobo Hall, Detroit.

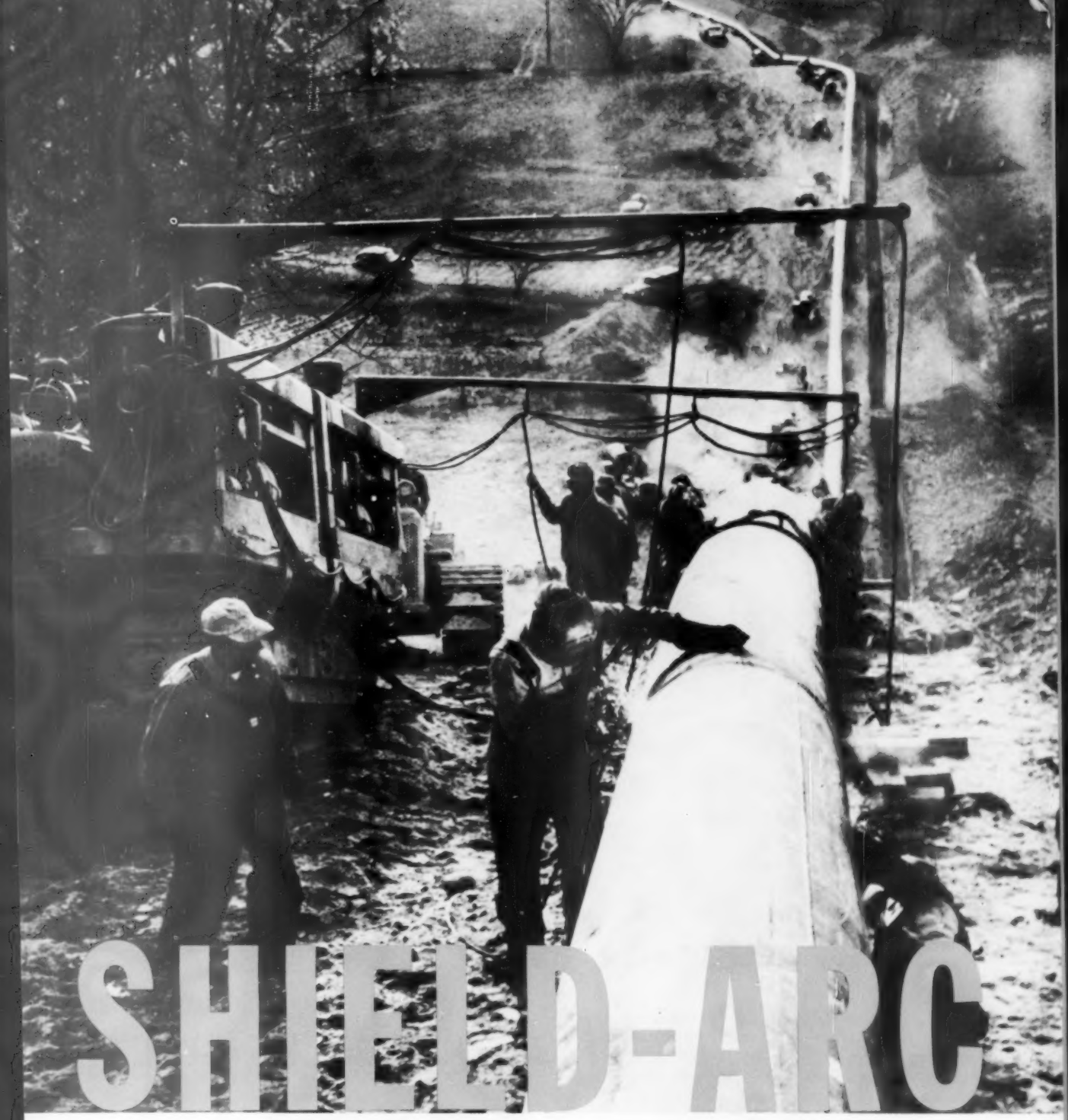
The Compressed Gas Association has elected the following officers: (left to right) D. M. Horner, Harrisburg Steel Co. and Taylor-Wharton Co., president; R. S. Passmore, ammonia division of Armour Industrial Chemical Co., 1st vice president; R. L. Swope, Southern Oxygen Co., 2nd vice president; and Franklin R. Fetherston, secretary-treasurer.

Navan to market air-acetylene torch

Navan Products, Inc., El Segundo, Cal., will market a new self-lighting air-acetylene torch for brazing and soldering.

The torch is made by Prest-O-Matic Co., Inc., Santa Ana, Cal.

For more facts Circle No. 156 on Reader Service Card →

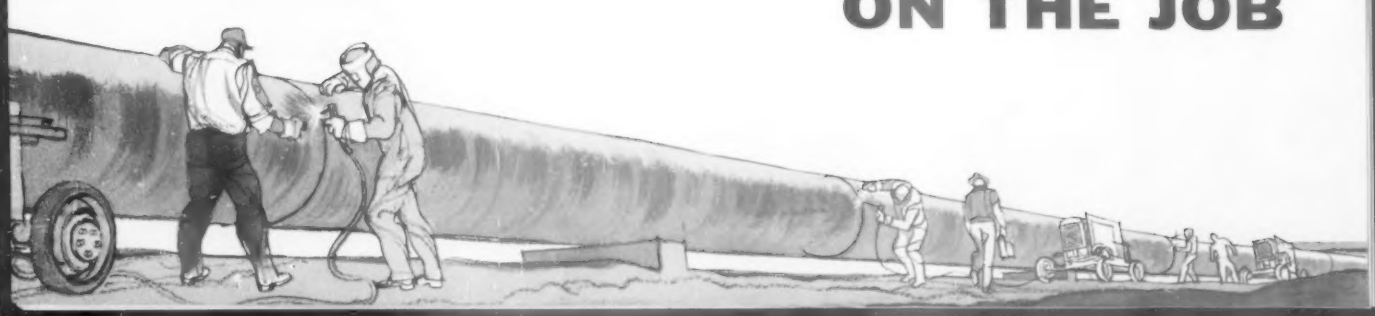


Stretch. Crane your neck. Squint. As far as you can see pipe—you'll see Lincoln Shield-Arc engine welders laying down metal. Why so many Lincolns? Because this contractor—after trying other makes—proved for himself that Shield-Arcs are unquestionably the best for day-in, day-out durability, operator appeal, reliability, low cost. The next few pages show why.

All-welded harbor warehouse in Long Beach, California, made architectural history as one of the largest, open-span buildings ever constructed. Contractor used Lincoln SA-200 welders which operate at low engine speed, require little maintenance, assure utmost reliability. The Lincoln SA-200 is by far the most popular gas engine welder ever built.

Even Louisiana swamps can't bog down these welding workhorses. Right this minute Lincoln machines are at work all over the world in the toughest imaginable field conditions—in jungles, Arctic ice packs, deserts. They're there on pipelines, refinery and building construction jobs because each part, from engine to brush holder to box-section frame, is built to give an extra margin of service, even when going is toughest.

THESE ARE LINCOLN SHIELD-ARCS ON THE JOB



Lincoln Shield-Arcs perform as well high in the Colorado mountains as they do at sea level thanks to the generous surplus power delivered by oversized engines. This reserve power means full generator output, no power drop-off even from older machines which have seen years of service. You get consistently excellent performance, low-cost maintenance, longest life with Lincoln Shield-Arc engine welders.

All construction welding is easy and trouble-free when you use Lincolns. They keep costs down, profits up. Weldors know, like and do their best with Lincoln machines. Dual Continuous Controls let operator select exact machine settings he knows will do the job best—whether flat, vertical or overhead. Idling device and design efficiency keep fuel costs low.

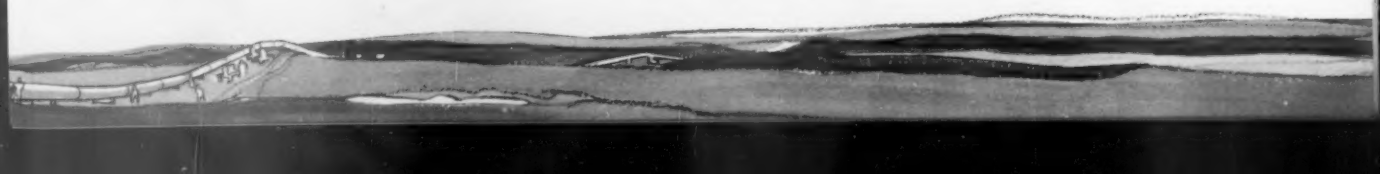
Chicago Bridge & Iron Company operates 685 engine-driven welders . . . 660 of them are Lincolns. Williams Brothers Company has 161 Shield-Arcs . . . all are Lincolns. Bechtel Corporation has 353 machines . . . 351 are Lincolns. And Pittsburgh-Des Moines Steel Co. has 53 at Neville Island . . . all Lincolns. There are many good reasons why these companies and others rely so heavily on Shield-Arcs.

Lincoln has a full line of gas or diesel machines . . . one for any job. Each is powered by a thoroughly proved-in-service Hercules, Continental or General Motors engine that will keep on running long after other equipment has given out. Idling device drops engine speeds to low idle to conserve fuel when not actually welding, automatically picks it up to operating speed when the arc is struck.

Each is equipped with Dual Continuous Controls which let a weldor select both welding heat and arc characteristics to suit his own technique. Once set, Lincoln Shield-Arcs hold their output indefinitely, won't drop off after extended use. This means better results on such critical work as stringer beads. Rugged, lightweight box-section bases on all Lincoln engine welders can stand the gaff when the going gets roughest.

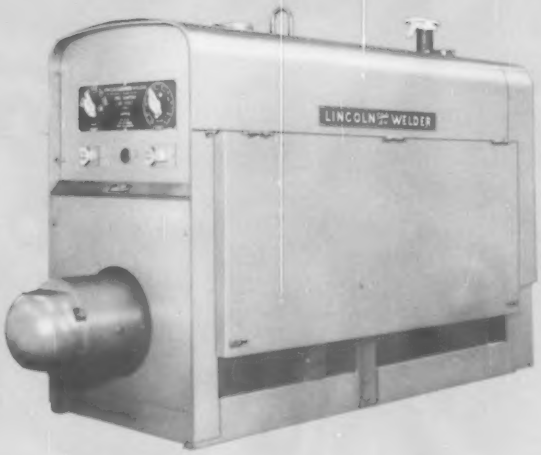
Why don't you get this kind of rugged dependability and sure-fire welding performance? Put Lincoln Shield-Arc engine-driven welders on your construction jobs. Get all the facts from your local Lincoln Field Engineer . . . a specialist in welding.

LINCOLN
WELDERS



SA-200 Most Popular 200-Ampere Engine Welder Ever Built

MODEL	SA-200
Current Rating (NEMA) at 40 volts	200 amps
Duty Cycle	60%
Current Range	40 to 300
Engine	Continental
Horsepower	36 @ 1450 rpm



SAE 300, 400 and 600 Machines Deliver Full-Range of Welding Currents

MODEL	SAE-300	SAE-400	SAE-600
Current Rating (NEMA) at 40 volts	300 amps	400 amps	600 amps
Duty Cycle	60%	60%	60%
Rated Current Range (amps)	60-450	80-600	120-750
Engine, 6-cylinder	choice: Hercules or Continental	Hercules	Hercules
Horsepower	47 @ 1400 rpm	63 @ 1400 rpm	82 @ 1400 rpm

Need Diesels? Pick from SAE 250, 300 and 400 Diesel Engine Welders

MODEL	SAE-250	SAE-300	SAE-400
Current Rating (NEMA) at 40 volts	250 amps	300 amps	400 amps
Duty Cycle	60%	60%	60%
Rated Current Range (amps)	50-325	60-450	80-600
Engine	Continental	GM	GM
Horsepower	35 @ 1700 rpm	35 @ 1675 rpm	50 @ 1625 rpm

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LINCOLN WELDERS

DATELINE: *Washington*

by Larston D. Farrar

A look at the economic forest — instead of the trees — indicates clearly that, despite problems, this can be the best business year on record in the United States. In fact, if the policies designed to stimulate the economy do not actually work to stymie new investment, there is every reason to believe that steady economic gains will begin to show up by April, followed by even more significant increases in May.

Construction already on the boards, by public as well as private spenders, is certain to be higher than it was in record-breaking 1960. Capital spending, now estimated at $36.5 billion, may well show greater gains as the year wears on.

Consumer income almost certainly will go over the $407.5 billion a year mark set in December, 1960. Some economists have estimated that personal income will hit $425 billion this year.

The view among business spokesmen here is that, except for the proposed minimum wage increase, business and industry generally endorse the Kennedy economic programs. The banking fraternity, naturally, resents his efforts to shave interest costs, but most businessmen applaud these efforts privately, if not publicly.

* * *

This first year of the new administration may be marked by fewer strikes and man-days lost by work-stoppages of any year in modern history. The reasons:

First, the price level is expected to remain relatively stable, thus negating a prime excuse for high demands from unions. Second, Labor Secretary Arthur Goldberg, although viewed with suspicion by some businessmen, seems determined to minimize labor-management strife.

Third, rising unemployment makes many employed workers wary about wanting to jeopardize their own jobs by jumping the gun and starting wildcat strikes. Fourth, the biggest industries (except auto manufacturers) already have union contracts that do not expire this year, and the threat of a crippling strike is remote. Fifth, the new labor relations act is working to eradicate illegal union activity and labor leaders who stand to gain by labor-management strife.

* * *

You and your customers will find it easier to negotiate bank loans, or to find capital credit from some source, this year than in any year in a long time. The Small Business Administration, under John E. Horne of Alabama, intends to increase the flow of federal credit in far stronger streams.

There are now almost 200 Small Business Investment Companies in existence in all areas of the nation. There will be many more in another year. The SBA negotiated some 21,000 loans totaling about $1.1 billion in its first seven years. It is believed here that SBA will approve that many in the next year or so.

* * *

A raft of legislation affecting business (beside the items from the White House) is to be considered in various Congressional committees this year, but most of it has only an outside chance of enactment.

The one bill that seems to have a good chance of passage would allow small businessmen to re-invest up to $30,000 out of profits, or 20% of their net, whichever is smaller, on a tax-free basis each year.

There is a strong groundswell of support for this bill running through all business sectors. The White House, so far, has not embraced the proposal entirely, but there were signs that it might even win Mr. Kennedy's personal endorsement.

Preformed Alloys

Whatever your particular job calls for there is a dependable GB *Pre*-formed Silver Brazing Alloy available. Rings, squares, ovals, rectangles, disks, rods, strips. U-shapes, L-shapes—*any* shape at all, and *any* size you require.

These convenient, efficient, economical *pre*-forms assure strong, safe joinings. A measured amount of silver brazing alloy produces a better looking and more cost controlled joint. You SAVE time, you SAVE money.

Write to us for a quotation on any of your preform requirements. Full particulars on Silver Brazing alloys and GB #88 Flux contained in the GB Silver Brazing Data Book will be mailed on request.

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Welding Engineer

America's pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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WELDING ENGINEER PUBLICATIONS, INC.
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WELDING ENGINEER is indexed regularly by Engineering Index, Inc.

Letters...

Senior subscriber

Sir: *Flushing, N.Y.*

WELDING ENGINEER should be proud that Ted Russell, Jr., is its senior subscriber (*See January WE, p. 24 — Ed*). Ted is a man who is dedicated to welding. Among his unique characteristics are his eagerness in considering new ideas and new ways of doing things (not a common enough trait today and a rare trait in the early days) and his willingness to be of help to others, Ted Russell, Jr., is also a gentleman and a swell guy.

Congratulations on your anniversary and congratulations on the caliber of your oldest subscriber.

Simon A. Greenberg
Industrial Consultant

Army weldors

Sir: *Aberdeen, Md.*

I am expressing my appreciation for various information I have found in *WE* which I have used to help train the future weldors of the Army.

M/Sgt. James L. Larkins

. . . to the dogs?

Sir: *West Boxford, Mass.*

"Job wanted — 7-year-old boxer desires job as weldor's helper."

Enclosed is a snapshot of my boxer, Bruno. My husband is a structural iron worker and weldor, and, as you can see in the picture, Bruno is wearing an iron worker's helmet.

My husband has been a subscriber to WELDING ENGINEER for several years and I thought it would be nice to see my weldor's helper in your magazine.

Pauline G. Noel

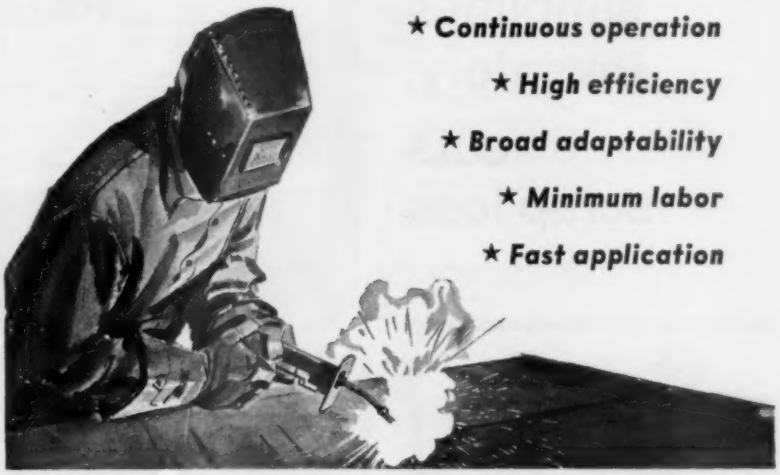
"I just can't weld zinc!"

NOW IT'S READY!

New Ranomatic *Wire*

For Automatic and Semi-Automatic Hardsurface Welding

RANITE manual rod quality now available in tubular coil wire for automatic and semi-automatic hardsurface welding



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RANOMATIC will be sold through your local **RANITE** distributor. For detailed information and prices ask him for bulletin No. R101, or write direct to Rankin Manufacturing Company.

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Now- all PAGE Welding Wire is COLOR-CODED

PAGE QUALITY PRODUCTS

AUTOMATIC WELDING WIRE

PAGE A-S-16

Customer No._____ Net Wt._____

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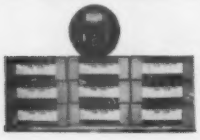
PAGE STEEL & WIRE DIVISION
American Chain & Cable Company, Inc.
MONESSEN, PA., U.S.A.

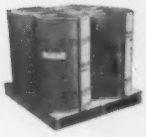
ACCO

New System simplifies inventory, cuts scrap loss



Cartons and spools both have new labels

Both the grade and color-coded stripes are printed on coil liners



New labels are on sides of Payoffpaks and Leverpaks

• For the first time, you can purchase all your automatic welding wire with permanent, color-coded identification. A new labeling system plus specially printed packages helps simplify inventory control, does away with scrap loss due to lack of identification.

Each label, in addition to its color code, shows complete information on grade, size, heat number, weight, and your order number. A typical label for reels is shown above—as the grades of wire change, so do the color combinations. PAGE's new system is the first comprehensive color identification program in the industry.

WRITE US at Monessen, Pa. for new pocket-sized color-code identification card plus new welding wire comparison chart

PAGE WELDING WIRE

ACCO

Page Steel and Wire Division • American Chain & Cable Company, Inc.

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston*, Los Angeles*
New York, Philadelphia*, Portland, Ore., San Francisco*, Bridgeport, Conn.
*Indicates PAGE warehouse stocks

PAGE

—the source for answers to welding problems

WELDING ENGINEER

Your March, 1961 *Weld World*

As WE went to press, these were the industry's latest developments:

. . A process for one-pass automatic welding in the vertical position will be demonstrated at the AWS welding show next month in New York City by Arcos Corp., Philadelphia. The electro-gas process uses a special flux-cored wire and carbon-dioxide shielding. It is designed to be used on plate 3/8 in. to 1½ in. thick.

. . Metal & Thermit Corp. has appointed Victor Equipment Co. its prime distributor in the 11 counties in Southern California. Victor's Northern Division also is an M & T distributor.

. . In another move, Victor has agreed to lease its compressed and liquid gas facilities at La Habra and Sacramento to American Cryogenics, Inc., parent firm of several oxygen producing companies. Under the agreement, American will produce gases sold by Victor in the California retail market.

. . Bridgeport Brass Co., Bridgeport, Conn., and National Distillers and Chemical Corp., New York City, are expected to merge shortly. Only approval of both firms' stockholders is needed. Bridgeport will operate as a division of National, with no change in management.

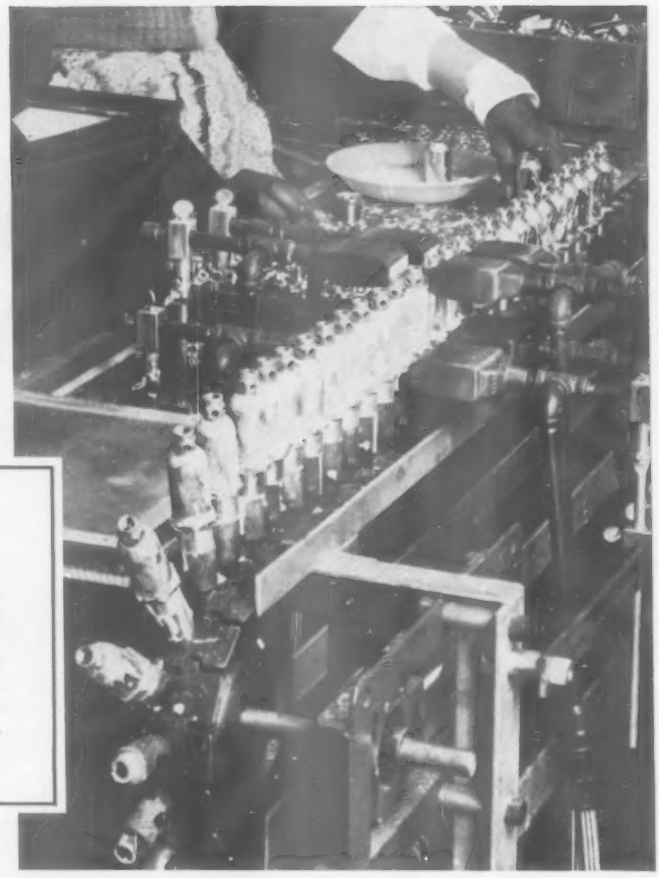
. . Several producers are expected to cut prices on aluminum welding wire shortly, according to reports received by WELDING ENGINEER.

. . Picker X-Ray Corp., White Plains, N. Y., claims it has developed a new image intensifier for industrial X-ray inspection that increases by five times previous limits of effective fluoroscopic magnification.

. . More than $29 million in equipment was delivered to industry last year by members of the Resistance Welder Manufacturers' Association — a 15.4% increase over 1959. Backlogs of almost $9.75 million were also reported at end of 1960.

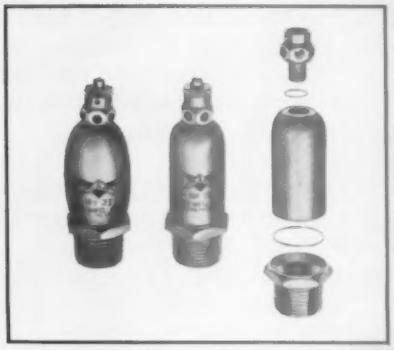
. . Oxyacetylene flame-cutting can now be controlled by magnetic tape which contains movement orders obtained from an electronic computer. Presently designed only for shipyard use, system entails putting dimensions, etc., on punched paper tape, which is fed into computer. Latter works out movements for machine's torches, and these movements are recorded on magnetic tape, which is played back on machine control console at shipyard. Same tape controls gas flow, automatic ignition and nozzle height. Machine has passed acceptance trials at British Oxygen Co.'s London plant.

. . Report out of Russia claims Soviets are turning out high-frequency-resistance-welded pipe at speeds up to 120 fpm. This for 40-in. OD pipe in 40-ft lengths. Power consumed is said to be only 75% of that required for similar units in this country.



Operator dips parts in HANDY FLUX and assembles them with EASY-FLO 45 rings on a moving rig. Assemblies then pass between banks of gas burners to complete brazing process. Capillary action of EASY-FLO brazing alloy insures thorough penetration—guarantees high strength, leakproof joints.

Flair No. 21 Hot Water Air Vent consists of the basic free-venting air valve, a generous air-collection chamber and a massive hex base. Two preform rings of EASY-FLO 45 are used in the brazing operation. Valve assembly at left was subjected to extreme pressure. Note how body ballooned; joints strong and leaktight.



How Flair Manufacturing Speeds Production, Eliminates Costly Casting With Easy-Flo Brazing

Never a field failure in any joint brazed with EASY-FLO 45 and HANDY FLUX—that's the proud record of Flair Manufacturing Company, Brooklyn, New York, makers of an extensive line of air valves and other specialties for steam and hot-water systems.

Flair finds that brazing with EASY-FLO 45 offers competitive advantages in every aspect of design, production economy and service life. Big savings are made through elimination of costly casting equipment and more productive use of space. Production is smoother, faster. Valves look better, last longer... in tests to 5000 psi, valve bodies burst while brazed joints remain intact. All this for an alloy cost per unit of approximately 2½¢ for two preform rings of EASY-FLO 45.

Speed, strength, economy, low labor costs—advantages *any* manufacturer would be glad to have. And, all achieved through use of Handy & Harman silver alloy brazing. Chances are silver alloy brazing could benefit your product too. If it could, or if you think it *might*, don't hesitate to get in touch with Handy & Harman. We'll help you in every way possible. Why not call us today?

DON'T MISS OUT...

on Handy & Harman's new silver alloy brazing Correspondence Course. Designed to put *all* the facts and techniques at your fingertips, this course is invaluable to everyone concerned with silver alloy brazing. Send for "Training Course Prospectus."

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Between passes

inventions wanted

Can you come up with a means of supporting stable observation platforms at fixed altitudes between 30,000 and 100,000 ft? If you can, your device is one of 123 inventions being sought by the Department of Defense. That agency, through the National Inventors Council, Offices of Technical Services, U. S. Department of Commerce, Washington 25, D. C., is hoping American civilian inventors can supply the brainpower necessary for the development of new devices and design improvements.

Some of the other problems challenging the imagination and ingenuity of the nation's inventors are development of a lightweight body armor able to stop projectiles from the most advanced anti-personnel weapons; small arms that are virtually noiseless, flashless and smokeless; a method of observing the inside of working rocket motors; and a distinctive audio signal device capable of making a sound like nothing normally heard.

The list contains an exhaustive assortment of other inventive needs including new ideas for testing applications: a notch-impact test for thin metal sheets; a non-destructive test to measure bond strength between similar and dissimilar materials; and a mechanical bond test for multi-layer laminates.

The 123 new developments needed by the Armed Forces are described in the free publication "Inventions Wanted" just published by the Council.

true blades

A new finishing process in which tool steel, welded to a carbon steel backing, is treated to within three-millionths of an inch of absolute smoothness, is reported as a major advance in quality paper cutters. A publisher of religious books says that the knives cut so smoothly that his firm has discontinued sanding operations prior to gilding the page edges of its Bibles.

NWPM

The above letters stand for National Welded Products Month. April will again be the month in which we should promote to the fullest the advantages of welding and welded products. Originated by WELDING ENGINEER several years ago, NWPM is now sponsored by the American Welding Society, which has chosen April because that is the time of its annual welding show and convention. This year's show will be held at the Coliseum in New York City on April 18-20. The technical meetings will be held at the Hotel Commodore in that same city from April 17 through April 21.

We cordially invite our readers who will be at the show to drop by our booth (719).

Bzzzzz

There's a growing use of steel in beehives. A manufacturer of bookbinding, stapling and other specialty wires is selling tin-coated wire to bee-keepers to provide added strength to the honeycombs that the bees build in the hives.

Improving upon Mother Nature?

science academy?

One of the proposals aimed at improving the nation's supply of engineers and scientists has been a national science academy. A New York congressman has introduced legislation to establish such an institution. But the National Society of Professional Engineers says it could prove to be the most expensive and perhaps least effective method. Paul H. Robbins, executive director of the 54,000 member society, says that while the bill clearly recognizes most of the basic problems involving engineering and scientific manpower, its approach toward a solution of these pressing problems would involve unnecessary duplication . . . and therefore expense.

"There is no need, as far as we can determine, for the Federal government to spend time, effort and money to establish an academy for the undergraduate and graduate education of engineers and scientists," Robbins said. "Our colleges and universities are presently capable of handling considerably more engineering and science students . . . at both levels. A federally sponsored institution . . . would only serve to duplicate facilities, to say nothing of the drain . . . on the already short supply of qualified instructors and professors."

headache

Every job has its headaches. But the editor's job can be especially exasperating, as noted in *Coronet* magazine. It states, "Professor Ernest Brennecke of Columbia University is credited with the discovery of a sentence that can be made to have eight different meanings by placing the word 'only' in all possible positions in the sentence: 'I hit him in the eye yesterday.' " Try it.

"Of course I'm proud of your interest in safety, Burton. But next time let's not panic over a couple of welding flashes."

NOW ATLAS OFFERS...

"Long Nek" Tomahawks

IF YOU WANT THE "MOST" IN A FULL WOOD HANDLE TOMAHAWK— GET A NEW "LONG-NEK" (WH) MODEL

Here's what the new "Long Nek" tomahawks offer: 50% greater support for the handle ● Protection of handle from splintering caused by working over an edge ● Less chance of handles loosening in the head ● Atlas wide-blade design that removes slag faster and adds to the life of the tool ● Hand-fitted hardwood handles ● Balance and "feel" that welders agree make their job easier

Come in three head styles to suit you and the job.

Tough!

Atlas makes 33 different weld cleaning tools. There's one for every purpose and preference—Ask your welding supply dealer to show them to you.

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WELDING ACCESSORIES
INCORPORATED
707 E. LEWISTON
FERNDALE 20, MICH.

In retrospect . . .

(Taken from **Welding Engineer** issues of March, 1916, 1931 and 1946)

—45 Years Ago—

Any increase in the size of the United States Army and Navy will necessarily affect the welding trade. More gas, for instance, will be required for welding and cutting and for the aviation and other departments. It is understood that the government is already making plans for the future.

Armour Institute of Technology, one of the best schools of its kind in the United States, though not as large as some, has installed an oxyacetylene apparatus manufactured by the Oxweld Acetylene Co.

—30 Years Ago—

The Sight Feed Sales Co., Dayton, Ohio, has been organized to sell and distribute products of the Sight Feed Generator Co., West Alexandria, Ohio. W. W. Boes is president of the new company.

Kansas City Oxygen Gas Co., Kansas City, Mo., has changed its name to Puritan Compressed Gas Corp.

Victor Welding Equipment Co. is reportedly about to buy Kimball-Krogh Pump Co. A new firm, under the probable name of Victor Equipment Co., is expected to operate the pump company and the welding equipment company as divisions. Management will be in the hands of L. W. Stettner, president; E. L. Mathy, vice president; and W. S. Fulwider, secretary.

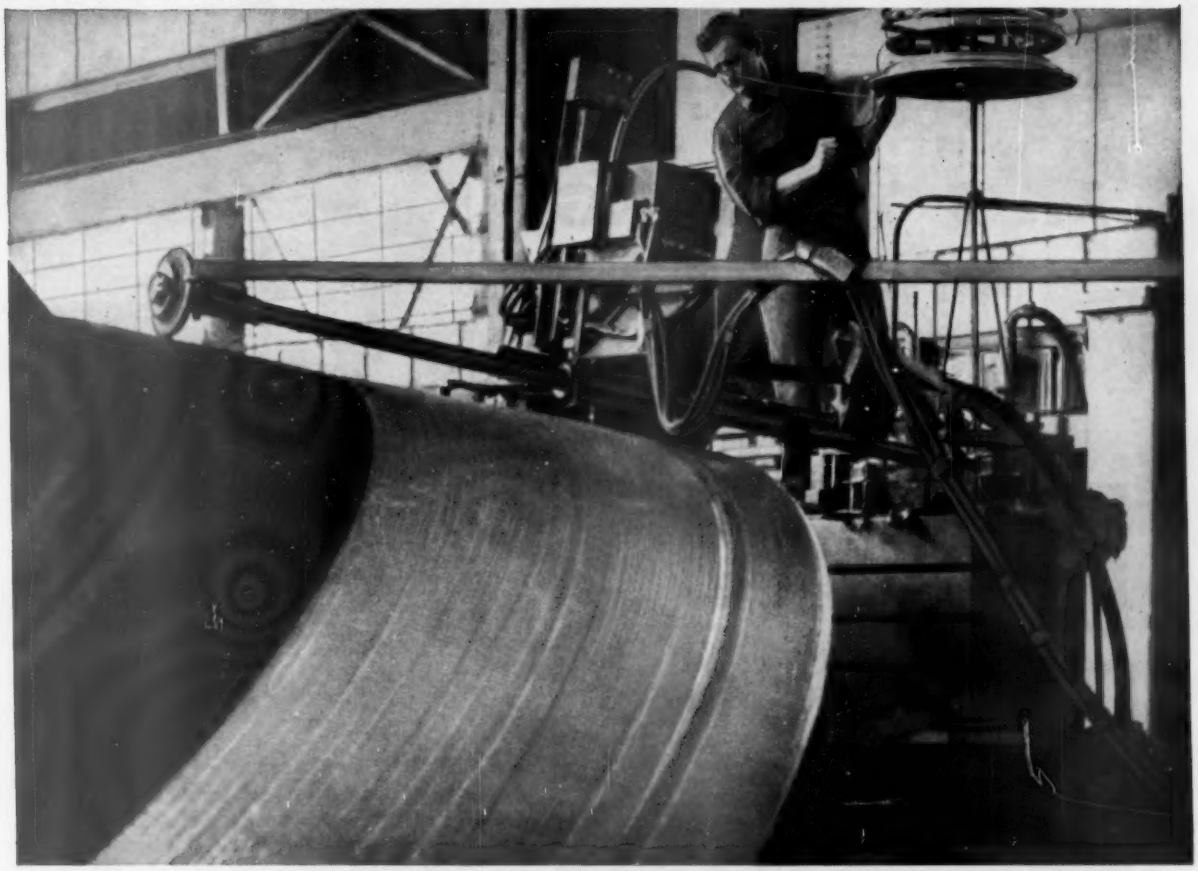
—15 Years Ago—

A new firm, the Resistance Welder Corp., has been formed in Bay City, Mich., with another office in Detroit from where sales will be directed. President is J. R. Brueckner; vice presidents are L. E. Nichols and C. F. Kaunitz; treasurer is F. C. Learman; secretary is L. W. Bartlett.

R. David Thomas, Jr., director of research and engineering for Arcos Corp. since 1940, has been elected vice president of the firm.

F. B. Jacob has been appointed sales manager of Thomson-Gibb Electric Welding Co., Lynn, Mass. H. W. Stieglitz will be assistant sales manager.

METALS LIVE LONGER...WHEN HARD-FACED WITH "HAYNES" ALLOYS



Submerged-arc welding equipment here deposits HAYNES hard-facing alloys on large areas of a 15-foot diameter blast furnace bell, to resist abrasion, impact, erosion.

Hard-Facing BIG Areas . . . Rapidly

Many big jobs are now being hard-faced with standard submerged metallic-arc equipment—using HAYNES alloys. The advantages: high rate of deposition, up to 20 pounds per hour; large cross sections faced without pre-heating; minimum deposit dilution by use of multiple layers.

For hard-facing gyratory crushers, blast furnace bells and hoppers, crusher rolls and jaws, tractor rollers—wherever impact, abrasion, heat, corrosion, erosion are problems—HAYNES alloys in drawn-tube rod form give the desired properties. They feed smoothly and uniformly.

Many smaller-area hard-facing jobs, too, are being done faster and at lower cost, on a production-line basis. Whether you hard-face large areas or small—whatever your hard-facing job is—it will pay you to insist on HAYNES rods. Our field engineers will gladly help you solve your hard-facing problems. Write us today!

HAYNES
ALLOYS
HAYNES STELLITE COMPANY
Division of Union Carbide Corporation
Kokomo, Indiana

UNION CARBIDE

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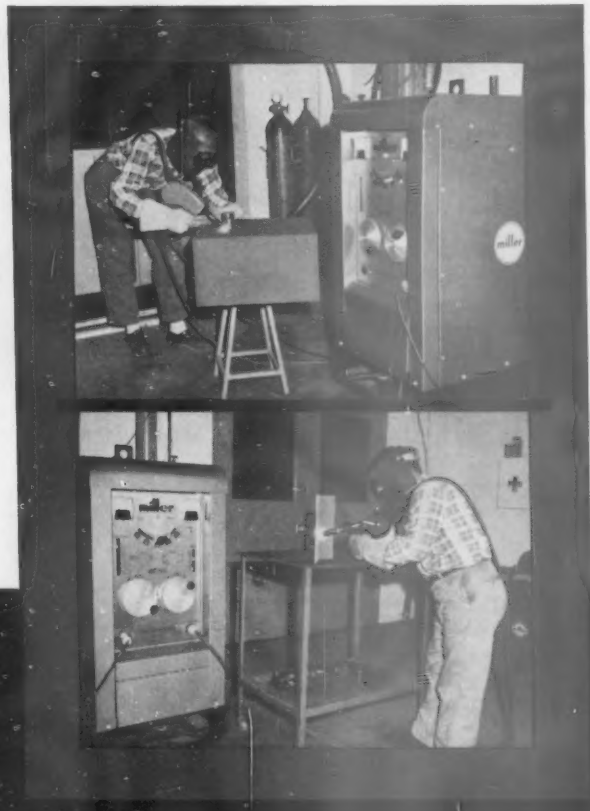
FINEST THING FOR

MIG WELDING

(using *any* shielding gas)

. . . is a MILLER CP-2 VS!

CP-2 VS



The Miller CP-5 illustrated below is a high output, constant potential d-c welder especially equipped to handle MIG welding applications on heavy plates and structures. This welder features five continuous adjustment voltage ranges operating from 500 amperes at 40 volts to 50 amperes at 10 volts. Slope control has fourteen positions. Convenient horizontal design is only 27½" high.

CP-5

Swift and solid success of Miller's variable slope d-c constant potential 300 ampere welder for all MIG work led to the development of the 200 ampere version shown here. Offered especially for use with recently introduced 200 ampere air-cooled guns having self-contained spools of wire, the CP-2 VS delivers:

Continuous voltage and slope adjustment • Current as low as 15 amps at 10 volts • A constant potential d-c source for heavy MIG work • Slope control with infinite continuous adjustment.

Information available upon request relating to 200 ampere CP-2 VS, 300 ampere CP-3 VS or 500 ampere horizontal model, the CP-5.

miller ELECTRIC MANUFACTURING COMPANY • APPLETON • WISCONSIN

EXPORT OFFICE: 3 West 57th Street, New York 19, N.Y. • Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

MARCH, 1961

OUR 45th ANNIVERSARY YEAR

Welding Engineer

ESTABLISHED 1916

Uncle Sam deserves a pay cut

FOR THE NEXT FEW WEEKS everyone in the United States will be more conscious of the government's "take home pay."

It is called income tax and very few of us even see or feel a major portion of this payment throughout the year.

The income tax amendment was voted in 1913 by people who wanted to "soak the rich." In its original form, the tax was to be 1% with a maximum of 6% starting at $3,000 for a single person and at $4,000 for those who were married.

All the original concepts of this amendment have disappeared long since. We are all "rich" now for nearly everyone gets "soaked."

Confiscatory laws have taken over and anyone earning more than $600 a year pays a minimum of 20% with a possibility of paying as much as 91% of their earnings to the Internal Revenue Department.

If you don't like this situation, you can do something about it!

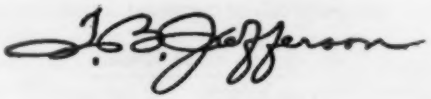
Thirty-three state legislatures have voted to petition Congress for an amendment to limit to 25% the maximum possible income tax. When one more state votes, Congress, by law, must act.

Some people will try to tell you that nothing can be done — but remember the prohibition amendment. When the people are sufficiently aroused, they will act.

If your state is not one of the 33, prod your state senator and representative into action.

No matter who is elected to public office, they become spenders. The more they have, the more they spend. And the more they spend, the less we will have. It's time Uncle Sam took a cut in pay.

Let's "have more" for everyone by curbing the spenders.



VICTOR

New gaugeless regulators

Available in VGS Single-Stage or VGT Two-Stage Models

1. Delivery pressure adjustment
—Simple and easy to adjust
—Readable on two sides
—Bold pressure readings stamped in cap
—Bright, easy-to-read pressure indicator

2. Inlet pressure indicator
—Enclosed and protected piston-type
—Clearly marked Full to Empty scale stamped permanently into metal
—Reliable 'O' Ring Seal

3. Listed under Reexamination Service of Underwriters' Laboratories, Inc.

The VGS400 series single-stage and VGT400 series two-stage regulators embody all of the time-tested and field-proved design characteristics that have made VICTOR Safety Regulators the choice of the man on the job. The use of pressure indicators instead of pressure gauges provides increased service for hard usage applications. Order from your Victor dealer.

Single-Stage Models		Two-stage Models	
VGS430-967	0-100 psig	VGT430-967	0-100 psig
VGS410-970	0-15 psig	VGT410-970	0-15 psig

VICTOR for regulators

VICTOR EQUIPMENT COMPANY

San Francisco, California
Los Angeles, California, Chicago, Illinois

MFRS. OF HIGH PRESSURE AND LARGE VOLUME GAS REGULATORS; WELDING & CUTTING EQUIPMENT; HARDFACING RODS; BLASTING NOZZLES; COBALT & TUNGSTEN CASTINGS; STRAIGHT-LINE AND SHAPE CUTTING MACHINES; ROLLER AND IDLER REBUILDING MACHINES

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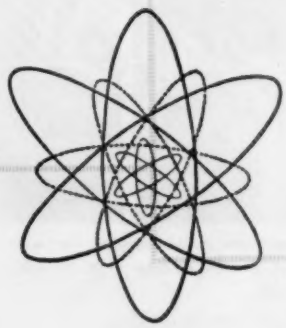
by **R. H. Hoefler**
Chief Welding Engineer
Kaighin & Hughes, Inc.
Toledo, Ohio



Fabrication of nuclear piping demands revised welding procedures

WELDING PROCEDURE qualification in today's nuclear age must involve more than just meeting ductility and strength requirements of bend and tensile tests prescribed by existing codes and standards.

In nuclear piping for example, operating temperature and pressure ranges are greatly expanded, and new metals and alloys are being developed to meet these new service conditions.

Thus, welding methods must be developed to join these metals and alloys, and an increased study of the welding arc and its influence on welding metallurgy must be conducted. (For a look at what the Navy is doing along these lines, see page 32.)

Weld failures during pilot plant studies of these nuclear applications definitely proved that the proposed installations could not be built — nor could they be operated — using normal fabrication or erection quality control procedures.

Therefore, the welding engineer must be advised as to the operating conditions of the various phases of the job, as well as the maximum limits of temperature, pressure, shock and/or corrosion that may be encountered. He must then select a filler material and a welding process (or combination of processes) to insure a complete weldment capable of meeting these ultimate service conditions.

Development of the welding procedure must begin with careful trial fabrication of the weldments, using the selected filler metal and welding process in all positions which may be encountered in actual fabrication.

All data concerning procedure variables (*e.g.*, amperage, voltage, filler wire size, travel speed, gas flow, flux type) must be recorded as the weldments are made. When completed, the weldments should be given the routine bend and tensile strength tests.

If these weldments can meet or exceed the requirements of these tests, they should then be subjected to further metallographic and chemical study, including macro-study, metallographic examination, radiography, hardness tests, low and high temperature Charpy tests and high temperature creep tests.

Following these testing procedures, weldment samples should be placed in stress, subjected to operating temperatures or temperature ranges for various lengths of time, and then re-examined by the previously used tests. Results should be carefully reviewed and the welding procedure written.

Included in the procedure must be the precise operation required to complete a satisfactory weldment and the limits to which the variables must be controlled.

(Certain procedures can be duplicated only with certain manufacturer's wire or electrodes, and when this is the case, trade names must be incorporated into the welding procedure.)

However, no matter how completely the welding procedure is outlined, it will not insure satisfactory weldments in shop or field unless the weldor is trained and qualified to follow these procedures precisely.

Quality control departments must be established at each job site and weldors trained and qualified under applicable procedures. Radiography, dye penetrant, magnetic particle and ultrasonic testing procedures must be established and carefully maintained.

To supervise all joint preparation and welding operations, the quality control department must work with the superintendent and project engineer. Weldors must be kept aware of their obligation to follow these procedures, as well as of the authority of the quality control department.

Because of the temperature range (—350 to +2,500 F) to which rocket and nuclear piping installations are subjected, notches in the root pass, cover pass or weld cross-section cannot be tolerated.

To eliminate or minimize these conditions, inert-gas shielded arc welding processes generally are used on these weldments. On larger weldments root passes are generally Tig welded using a consumable insert while succeeding passes are submerged-arc welded or manual metal-arc welded.

(During deposition of the root pass, penetration, fusion and puddle size are controlled by the weldor using a remote-type foot con-

FIG. 1 — Weldor joins stainless steel pipe which has ⅜-in. maximum wall thickness. The weld (see drawing) is made in successive passes with a 3/32-in.-diameter tungsten electrode. Current is 100-140 amp at 20-24 volts.

trol. This foot control is also required to taper the current and prevent crater cracking as the bead is completed.)

Figure 1 shows a weldor joining stainless steel pipe which has 3/8-in. maximum wall thickness.

Using argon gas as the internal purge and the arc shield (at a flow rate of 12-15 cu ft per hour), the weld is made in successive passes with a 3/32-in.-diameter 2% thoriated tungsten electrode. Current is 100-140 amp at 20-24 volts, and weld direction is from bottom to top.

Figure 2 shows a completed stainless weldment in which the root pass was laid with the Tig process using a consumable insert. The submerged-arc process was used on cover passes on roll welds, and manual metal-arc was used on position welds.

Wall thickness of the pipe was 3/8 to 3/4 in. The first manual metal-arc pass made with 1/8-in.-diameter E308L-15 electrodes; the remaining passes were made with 5/32-in.-diameter electrodes. Amperage and voltage were determined during electrode evaluation.

The submerged-arc cover passes were made with a 3/32-in.-diameter stainless steel wire at 260-290 amp, 32-34 volts. Flux was Arcosite type S4.

A blanket of argon was maintained on the inside of the pipe during all welding operations. All welds were dye-penetrant tested between passes and the completed weldment was 100% radiographed. The completed sections were thoroughly degreased and examined with a black light before being accepted for installation.

The foregoing procedures for proper welding and quality control should not be limited to rocket and atomic installations, however.

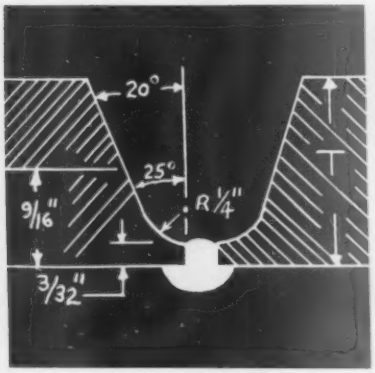
Pipe and fittings for all installations are furnished as a specified alloy to an ASTM designation. These standards require certain chemical, metallurgical, destructive and non-destructive tests to be conducted and established minimums exceeded before a material is approved for classification and sale.

Unless these pipes and fittings are joined with welds that maintain similar chemical, metallurgical and cross-sectional tolerances, the standards and tests involved at the mill are of little value to the fabricator.

Thus, the basic difference between welding pipe for a nuclear installation and for a refinery or chemical operation is in the additional cleaning and polishing of completed weld surfaces, and not in the chemical, metallurgical and cross-sectional tolerances of the properly made weld.

Welding procedures for *all* services must be carefully selected to meet in-service variables. And the procedure must be properly applied.

FIG. 2 — Completed stainless weldment in which root pass is laid with Tig process using consumable insert (see drawing). The submerged-arc process was used on cover passes on roll welds, and manual metal-arc was used on position welds.



FIBER metal disc is placed between sheets to be spot welded by researcher Robert Nolen. The disc may be similar or dissimilar to the base metal members.

- ✓ *Lower power requirements*
- ✓ *Greater efficiency*
- ✓ *Highly conductive metals welded*
- ✓ *Less electrode indentation*

Fiber metallurgy promises greater efficiency in resistance welding

by **Harry Schwartzbart**
Assistant Director
Metals Research
Armour Research Foundation

RECENT APPLICATIONS of fiber metallurgy, a development in which thin fibers of metal are interlocked like felt cloth, promise greater efficiency in resistance welding.

The fiber metal body is prepared by suspending short (1/8 to 1/2 in.) lengths of metal fibers in glycerine, stirring to ensure that they are dispersed, and felting to produce a porous body.

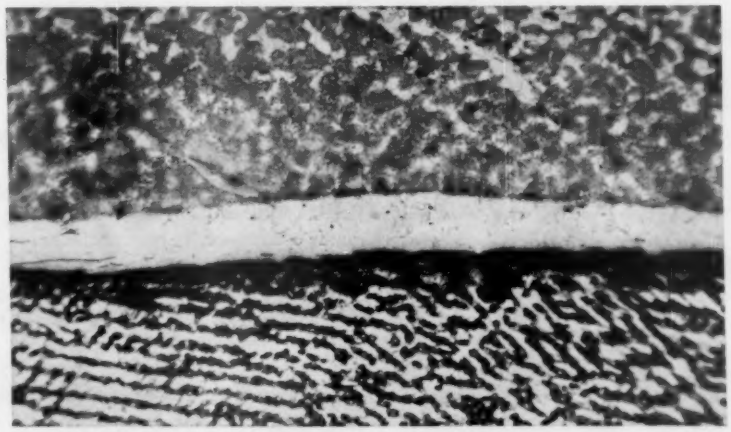
This body is then pressed or rolled to any desired density and thickness, and then sintered.

Called fiber metal resistance welding, the welding method consists simply in the placing of a piece of fiber metal sheet between those surfaces to be resistance welded.

The fibrous mat presents a multiplicity of contact resistance to the passage of current, and the metal in the mat therefore can reach its melting point while the base metal remains relatively cold. In effect, the ratio of contact resistance to bulk resistance is increased and the thermal gradient away from the weld interface is steepened.

If circumstances dictate, the mat may be impregnated with a filler alloy having a lower melting point than the base metal, as is done to the mat or shim used in fiber metal shim brazing (see boxed material on next page).

The advantages of fiber metal resistance welding are best illustrated by reviewing the standard resistance welding processes to which it can be applied: spot,



RESISTANCE weld was made between mild steel and cobalt alloy. Fiber metal mat was of mild steel and the surfaces welded were inclined to the electrode force axis.

BRAZED joint was made on mild steel base metal. Joint material was copper-impregnated mild steel fiber metal shim.

Fiber metal brazing surmounts wide gaps and poor fit-up

THE FIBER METAL MATS described in the adjoining article have also been used to develop a new brazing method which will enable joints to be made despite wide gaps and poor fit-up.

Called fiber metal shim brazing, the process is based on the same fiber metal mat as in resistance welding except that the mat or shim is impregnated with a filler metal having a lower melting point than the base metal.

This shim is placed in the joint gap to make the brazed joint. The joints can be made at wide gaps because the filler metal is supported in the fibrous body which provides a multiplicity of fine capillaries. In addition, the fiber reinforcement of the relatively soft filler metal increases its bulk strength.

• • •

Wide variation in behavior is possible by control of the fiber material's composition, the impregnating material, the relative proportions of the two, and the diameter of the fibers. A further advantage: since the fiber shim is compressible, relatively poor fit-up of the surfaces to be brazed can be tolerated.

A variation of the process is to make the mat by combining fibers of the individual elements in the desired proportions, then pressing or rolling to 100% density and finally sintering.

• • •

Fiber metal shim brazing has unique advantages in the brazing of refractory metals, particularly tungsten and molybdenum. Because these metals are brittle in the recrystallized condition, it is advantageous to braze them below the recrystallization temperature.

This is done by diffusion or volatilization to eliminate the temperature depressant from the filler alloy, leaving a joint of higher remelt (hence, service) temperature.

Diffusion of the layer of filler metal into the base metal in a conventional brazed joint requires excessive time and temperature. However, a brazed joint made with a fibrous mat of base metal and impregnated with the filler metal, results in a fibrous base metal network that is highly efficient diffusion sink for the filler metal because of its high surface-to-mass ratio.

A further advantage is the ability to increase the filler metal viscosity where needed, *e.g.*, on curved brazed panels where gravity and excessive flow concentrate the filler alloy at the low points.

seam, projection and resistance butt welding.

In spot welding, two sheets to be joined are placed between two cylindrical electrodes and a current is passed through the sheets. Because of contact resistance at the interface between sheets, a thermal gradient exists through the sheet thicknesses and the material at the interface reaches the melting temperature first.

At an appropriate time, current flow is terminated and the molten material solidifies into a nugget. Location and size of the nugget depends on the location and size of the electrodes, as contrasted to projection welding.

The steepness of the thermal gradient through the thickness of the sheet is a function of, among other things, the contact resistance at the interface relative to the bulk resistance of the base metal.

The greater the difference between these two resistances, the steeper is the thermal gradient. (For our purposes here, cooling provided by the electrodes has been neglected.)

Normally, there exists an appreciable heat-affected zone around the cast nugget, in which beneficial effects of cold work or heat treatment may be lost. Martensite also may be formed in the heat-affected zones of spot welds in some steels because of the rapid cooling rate.

Heating of the base sheet and electrode pressure cause indentation of the sheet by the electrode — an undesirable effect. Because of these and other considerations, it is sometimes definitely advantageous to increase the ratio of contact resistance to bulk resistance, thereby creating a steeper thermal gradient through sheet thickness.

Seam welding is identical to spot welding except that the electrodes are in the form of wheels, and the spot welds are overlapped to provide a continuous weld.

Projection welding differs from spot welding in regard to the means of locating welds. As mentioned above, in spot welding the size, shape and weld location depends on the size, shape and loca-

tion of the electrodes, while in projection welding dependence is on the size, shape and location of projections on the work to be welded.

For example, if a ring is to be welded to a plate, a projection can be provided either on the ring or the plate. The assembly is then placed between flat electrodes and current passed through the projections, heating the pieces in the region of the projections.

As the size of the pieces to be welded increases, this welding process becomes more critical and is less likely to yield reproducible results as the machining tolerances of the individual piece parts are more relaxed.

This logically follows from the strong effects of pressure on contact resistance, and of mismatch, cocking and misalignment on projection contact and current distribution.

It is basic to sound projection welding design that the surfaces to be welded be perpendicular to the electrode force axis. A force component which applies shear to the surfaces to be welded may cause relative sliding or displacement, decreasing the chances of making a sound weld.

In resistance butt welding, current (which is introduced through clamps) is passed through the bars to be butt joined. Generally, upsetting pressure is applied so that some barreling of the bars is produced.

Under these circumstances the ratio of contact resistance to bulk resistance is not high. Thermal gradient along the length of the bars away from the interface is not steep. Base metal is also heated considerably, destroying the beneficial effects of cold working or heat treatment.

In this case again, a definite advantage may be had from increasing the ratio of contact resistance to bulk resistance and increasing the steepness of the thermal gradient away from joint interface.

Some of the advantages are detailed in the box below, but not necessarily in order of importance.

Actual experimentation performed to date on the many variations possible with fiber metal resistance welding has been limited. However, the process' potentiality can be seen from the areas in which experiments have been conducted:

1 — Fiber metal resistance butt welds have been made in one centimeter square bars heat treated to a hardness of RC 37. The thermal gradient in the joined bars during welding was so steep, the hardness of the base metal was uneffected by the welding operation 1/8 in. away from the joint.

2 — Projection welds in which the surfaces to be joined are inclined to the electrode force axis have been made with the fiber metal technique, the most satisfactory approach now available.

3 — Fiber metal resistance spot welds have been made in steel.

4 — Ductile fiber metal resistance spot welds have been made in molybdenum sheet, using a fibrous mat composed of molybdenum and iron fibers.

Advantages of fiber metal resistance welding

1 — In all processes, the power required to make a weld with fiber metal resistance welding is lower than for conventional resistance welding. Less energy is expended in heating metal away from the interface because of the steeper thermal gradient.

2 — It is possible to weld cold-worked or heat-treated metals without destroying beneficial effects of treatment by welding heat. Although this applies to welding of all metals, it is particularly significant for molybdenum and tungsten, where recrystallization is especially embrittling.

3 — Fiber metal resistance welding raises the possibility of welding high-conductivity metals such as copper, which is now considered difficult to resistance weld, because of the difficulty in concentrating enough weld heat at the interface to reach the melting point.

4 — Using the fiber metal approach, it is easier to make resistance welds between dissimilar metals. Because of the wide latitude in formulating the fiber metal mat, it may consist entirely of one of the base metals, or of an alloy similar to or differing from the base metal(s).

5 — Because resistance welding is so dependent on contact resistance (which is sensitive to pressure, surface films and dimensional control) increasing the ratio of contact resistance to bulk resistance should increase reliability by decreasing sensitivity to extraneous factors.

6 — Less electrode indentation is obtained in fiber metal spot or seam welding than in conventional spot or seam welding. The base metal away from the weld interface remains cooler and is better able to resist indentation.

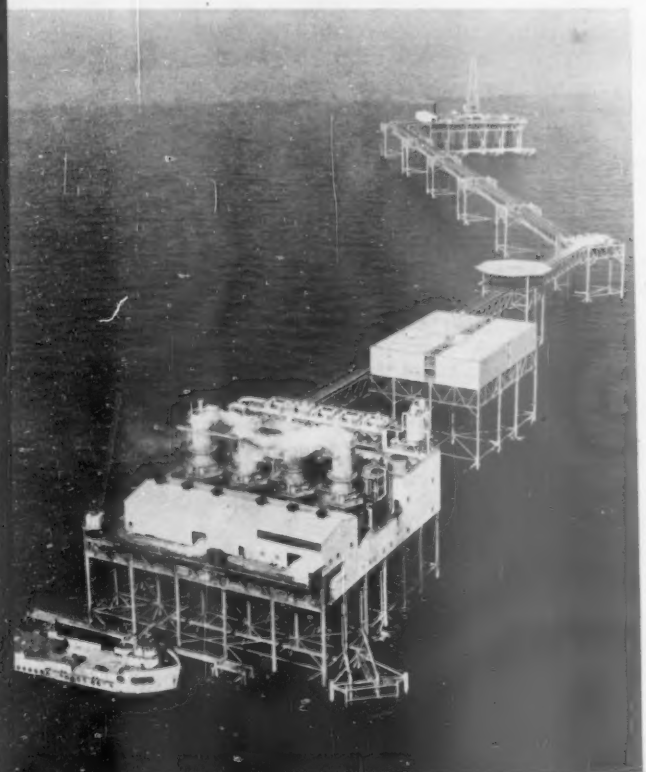
7 — Clad metals, both plate and sheet, are finding increased application in numerous industries because the desired properties of two or more metals are provided in one plate or sheet. If a fiber metal sheet is inserted between the two sheets or plate to be clad, wide wheel seam cladding becomes more practical because of its lesser sensitivity to pressure variations as mentioned above.

8 — Fiber metal resistance welding eliminates the requirement that the surfaces to be projection welded must be perpendicular to the electrode force axis.

Steel island is $30 million sulphur mine

Tig, submerged-arc welding are used to construct pilings and pipelines for the project.

by T. Anderson and E. L. Trimble*



TIG welding with filler rod joins steel pipe for molten sulphur line.

A $30-MILLION STEEL ISLAND and pipeline constructed with the help of submerged-arc and Tig welding is ready to mine one of the largest sulphur domes ever discovered.

Freeport Sulphur Co.'s island in the Gulf of Mexico is located seven miles from Grand Isle, La. Supported by submerged-arc welded carbon steel pilings, the massive steel island stands 2,000 ft. above 30 to 40 million tons of sulphur.

Although this vast dome is not needed today, because of heavy mainland output from mines and the by-product of oil refineries and natural gas, it provides the assurance of a great future source.

Seven miles of 282-ft. 30-in.-diameter submerged-arc welded carbon steel pilings were driven 170 ft. into the ocean bottom to support the steel island. These pilings rise 60 ft. above the water surface.

Before welding, the ½-in.-thick joints of the pipe sections for the pilings were beveled to a 60-deg included angle. Pipe sections in 10-ft. lengths were then joined by submerged-arc welding equipment supplied by Linde Co., New York City. Welds consisted of a stringer-bead pass and a hot pass.

Welds were then cleaned by wire brush, followed by chipping where required.

As this pipe rotated on rollers at 18 ipm, the welding head applied two cover-pass welds using a control set at a current of 475 amp at 30-32 volts. Production rate for the welding fixture was 20-25 joints per day. No post-weld finishing was required for the fully-penetrated X-ray quality welds.

Using steel templates as pattern spacers, the welded piles were then driven by derrick barges. The templates remained in place as underpinning to stiffen the pilings against the waves.

Elements for the half-mile steel island, made up of five large and five smaller steel towers connected by 20-ft. bridge spans, were prefabricated on shore. The complex seven-mile pipeline for the transportation of molten sulphur from the steel island to the shore was Tig welded, also on shore.

The 6-in. OD sulphur line, designed to carry a maximum of 4,500 tons of molten sulphur per day,

SUBMERGED arc welding joins 30-in.-diameter carbon-steel piping into 282-ft. pilings to support the offshore mine structure.

runs inside a 7 5/8-in. OD hot water line (see picture). Since sulphur solidifies at 240 F, the line must be able to withstand temperatures of at least 280 F.

Carried "piggyback" (see diagram) are a 4-in. water-return line plus a 6 5/8-in. bell-and-spigot fresh water line.

Welding of all this pipe was done on Grand Isle. The 2,000-ft. pipe-fabrication line ran nearly the full width of the island.

Steel pipe with a minimum yield strength of 6,000 psi and resistant to embrittlement cracking by hydrogen sulphide (plus having qualities associated with less than 22 Rockwell C hardness) were used for pipelines.

All butt joints were Tig welded with the first cover pass being made with a bare ⅛-in.-diameter filler rod of approximately the same chemical composition as the pipe. Final buildup passes were made with manual welding using low hydrogen electrodes.

Because all testing and assembly of the welded lines had to be accomplished within the 2,300-ft. width of Grand Isle, the pipe test lengths were limited to 1,000 and 2,000 ft. Completed welds received 100% radiographic inspection followed by hydrostatic testing at 1,350 psi for the 6-in. line and 1,800 psi for the 7⅝-in. line.

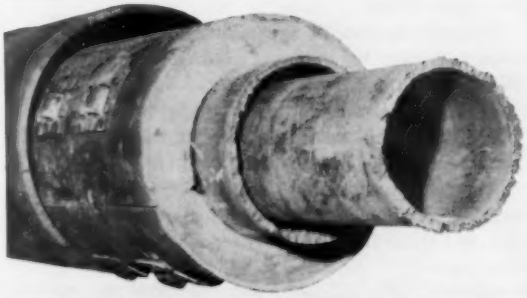
The 1,000-ft. strings were then pulled into one another with winch tractors. The 6-in. line was pulled into the 7⅝-in. line, and the latter, following installation of spacer rollers and insulation, was pulled into the 14-in. line. These 1,000-ft. multiple pipe sections were then joined by Tig welding.

On an adjacent rack, the two "piggyback" lines and a 16½-in. diameter flotation pipe (for off-setting heavy pipeline negative buoyancy) were similarly welded.

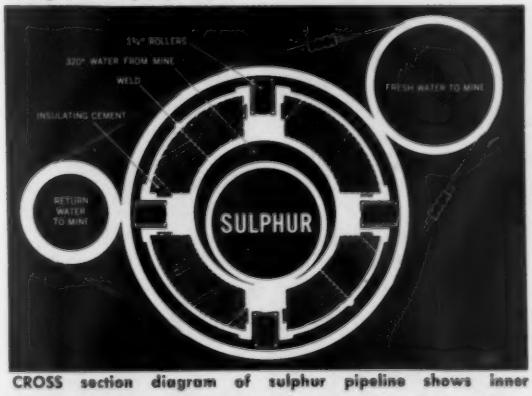
Total fabrication time, including preparation of the assembly site, was 52 days. Complete adjustment and cleanup of the pipeline required 27 days.

**Mr. Anderson and Mr. Trimble are regional electric welding managers of Linde Co. in Birmingham, Ala., and Kansas City, Mo., respectively.*

PIPE fabrication line 2,000-ft long runs full width of Grand Isle, La.



ACTUAL cross section shows 6-in. sulphur line inside 7⅝-in. hot water line with thermal insulation, expansion rollers and outer casing (see diagram below).



CROSS section diagram of sulphur pipeline shows inner sulphur line, hot water jacket and outer casing. Carried piggyback are fresh water and return water lines.

SAN DIEGO harbor hosts two submarine tenders, *U. S. S. Nereus* (foreground) and *Sperry*. Each has its "brood" of submarines along side for repairs.

Navy welding school takes its first steps into the nuclear age

by **James Hurlburt**
U. S. Naval Station
San Diego

THE ADVENT OF NUCLEAR-powered and guided missile ships has created a need in the U. S. Navy's at-sea repair forces.

Wanted: men with the ability and knowledge to cope with this "big-step-up" from conventional World War II ship construction.

To help meet this challenge and bridge the change-over period, the welding school at the U. S. Naval Station, San Diego, is making rapid changes.

A curriculum is being drafted that will set up new training schedules so that the fleet's weldors will be able to handle the numerous requirements of modern ship repair.

These requirements include welding of stainless steel in unlimited thicknesses, making seal welds on stainless steel piping systems, and high-pressure hull steel welding.

With this and other instruction during the 24-week course being proposed, the Navy's need for highly qualified and specialized weldors is expected to be readily filled.

Assistance in establishing the curriculum is being obtained from welding engineers located at naval shipyards on both coasts, and from industrial engineers associated with such work.

In this way, the training schedule can be brought to the level of the naval shipyards where these repair techniques are already in use in today's nuclear-age ships.

It is hoped that the new curriculum will ultimately reach such a high level that the welding school will be one of the best in its category.

At the present time, the Navy welding school has a 12-week course, with an additional supplementary six weeks of welding instruction for top-rated personnel.

CHIEF petty officer runs a bead on 6-in. chrome-moly pipe using a 5/32-in.-diameter chromium-molybdenum electrode.

STUDENT weldor joins 3/4-in. high-pressure hull plate using a 5/32-in.-diameter low-hydrogen electrode while an instructor looks on.

Qualified senior petty officers and a limited number of qualified men from allied navies take the 12-week course to refresh previously acquired knowledge of shipboard welding techniques.

Because of work day limitations in some shipboard jobs, a number of these students have acquired more welding experience during their fleet tours than others. The 12-week course, however, is geared to level-off this difference at the beginning and then proceed from there. The average class has about 30 men.

During the first eight weeks arc welding of mild steel and application of low-hydrogen and chromium-nickel steel electrodes are the major areas of instruction.

Much of the student's time is spent in the shop where each man has sufficient equipment at his disposal to complete all the welding projects assigned.

In the last four weeks of the course, the students go into the theory and practice of gas welding, and low-temperature aluminum and silver brazing.

After completion of this course, the six-week supplementary instruction is available for a few of the top men in each class. This shorter course is geared to instruct the weldor in the more advanced and complex shipboard welding techniques.

Subjects cover Tig and Mig welding, hardfacing, stainless and high-nickel alloy welding, etc. A recent addition to the curriculum is pressure hull welding, which coincides with the construction advances made in nuclear and guided missile ships.

An example of shipboard training currently being done can be found aboard the submarine tender *U. S. S. Nereus* (AS-17).

The ship's welding shop is located on the main deck between the foundry and shipfitter shops. There are nine weldors assigned to the shop, three of whom are completely qualified and specialized enough to handle all ship-repair welding jobs.

WELDING class in session at Naval Station welding school. Instructors and students prepare high-pressure hull plate and stainless steel for welding projects.

These include welding HY-80 alloy steel in unlimited thicknesses, high-pressure hull welding, and seal welds on stainless steel piping for nuclear submarines.

Much of their training is the result of many years of experience, plus a varied sequence of training either on-the-job or in-service at shipyards and available Navy schools.

The proposed 24-week course will stabilize to some extent this loose-end method of gaining the latest in welding knowledge. As a result, more men with a moderately higher level of welding capability will be sent back to the fleet's repair forces.

Navy specifications are rigid and only a highly qualified weldor can meet them.

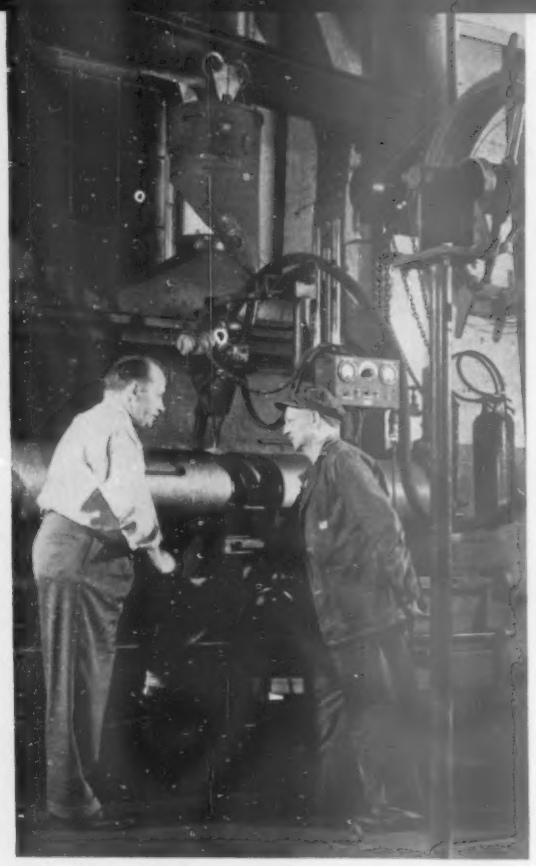
For example, suppose one of the nuclear submarines came along-side the *Nereus* for repairs. Before a weld can be made on some piping, it may take as long as three weeks to pass through a complete cleaning sequence.

Special passageways, cleaning rooms, sandblasting and X-ray inspection are some of the precautionary steps taken before the piece reaches the welding shop for repairs.

Therefore, a seal weld on this nuclear-associated stainless piping system must be done by a highly qualified weldor if it is to pass the required inspection.

Included in the inspection is radiography. With the adoption of iridium-192 and cobalt-60, gamma radiography is finding a place in the Navy. Fleet repair forces are now using these methods, and the Naval Industrial Radiograph school at the Naval Station is incorporating it in its present standard X-ray instruction.

Thus, Navy welding is preparing itself for the nuclear age.



PERSONNEL at Ford's Rouge plant in Dearborn, Mich., examine submerged-arc lathe welder used for salvaging equipment.

by F. T. Tancula

Much equipment that is scrapped can be salvaged at a big cash saving as evidenced by the fact that . . .

Proper welding saves thousands of dollars for Ford Motor Co.

WELDING HAS LONG LEFT the confines of its humble start as a maintenance process. But it still plays an important role in salvaging equipment that otherwise might be scrapped.

Ask the Ford Motor Co.'s Steel Division. Its miscellaneous shops maintenance department, located at the Rouge plant in Dearborn, Mich., has saved the firm thousands of dollars annually through proper welding procedures.

Ford's normal policy: if salvaging costs approach a certain percent cost versus cost of new, buy it new. If costs are below that figure, rebuild it.

Working with a steel division, you can expect to encounter a wide range of repair jobs. Here are several examples of savings produced by maintenance:

Entry rolls

Entry rolls for slab reheat furnace needed to be "fattened up" from 13½-in. to 15¼-in. diameter because of redesign of entry level of furnaces. Welding speed was 18-20 ipm on the lathe welder. Current was 450 amp, 27 volts.

A 5/32-in. diameter 0.65% carbon steel filler wire which contained about 1% manganese was used to build up the rolls. Cost: 28% of replacement.

Shear-blade holder

The seat and lock-bolt holes of a slab shear-blade holder were worn to the stage of uselessness. (The hydraulic shears cut slabs up to 6-in. thick.)

Using a low-carbon filler wire for earlier passes, medium-carbon wire for finish passes, the longitudinal welds were made with automatic submerged-arc equipment.

Savings: tremendous. Rebuilding and machining came to only 20% of what replacement would have cost.

Slag car frames

Despite the trend to automation, older processes still find application in the Steel Division. Thermit welding is used to repair side frames on slag car ladles.

Continual humping causes the frame to break at the critical area of shock and impact (see photo). The "lost-wax" thermit weld process joins the broken frame after which a gusset, 1½-in. by 25-in. long and contoured to fit the sweep of the frame, is welded to the frame as a strengthening member.

These frames are rough cast steel and are finished at contact points only. They resemble channel sections.

James Barnes, superintendent, and Art Holm, his general supervisor of welding and fabricating, said that not one car frame repaired by their department has ever been returned for further repair. And the first left the maintenance shop more than 20 months ago.

Back-up chucks

Automatic equipment has helped Ford achieve further savings in comparison with previous methods of repair within its own maintenance department. For example, it formerly took 128 hours to manually weld the bore of a back-up chuck for a hot strip mill. Using automatic equipment and a positioner (purchased), weld time (including set-up time) is now only 18 hours.

In addition to obvious labor savings, the automatic procedure has cut drastically (about 35%) the machining time, because the submerged-arc welds are more even, less erratic.

There are 98 such back-up chucks (including spares) in the Steel Division. Bearings for each chuck cost well over $10,000, so a constant check is necessary to avoid expensive replacement.

Welding costs are relatively small — one layer of 5/32-in. medium-carbon wire is deposited on the 28-in. inside diameter of the chuck, then machined to take bearing surfaces.

Ford has work-roll chucks which are similarly repaired with one layer of medium-carbon wire, using automatic equipment and a positioner. These number 180, including spares, and each has an ID of 13½ in.

If bearings become worn because of tardy repairs on the chucks, all must be scrapped, so savings accruing from constant inspection are readily evident.

Collar rolls

Collar rolls for blooming mill have been repair welded and reinforced on a specially designed welding-head manipulator. Rolls are rebuilt with 5/32-in. medium-carbon wire at 425 amp, 27 volts. About 15 lb of filler metal per hour was deposited with this Ford-designed and built equipment on this particular application.

Longitudinal travel (and thus welding "reach") of the manipulator is 30 ft. Vertical travel is 8½ ft.

Leveling rolls

A cluster of nine pickle-line leveling rolls were wearing. By rebuilding and hardfacing with submerged-arc welding, life of the rolls was prolonged to four times the estimated life of new rolls.

Cost (including grinding): 64% of what replacement rolls would have cost. This percentage is unusually high, according to Ford spokesmen, but more than offset by extended life of the rolls. (New rolls would need repair three months after installation. Rebuilt rolls will last 12 months.)

The hardfacing was done with a 5/32-in. wire at 400 amp, 25 volts. Welding speed was 18-20 ipm and both rebuilding and hardfacing beads were laid down while the rolls rotated on a special lathe welder under a submerged-arc head.

Fabrication

In special fabrication jobs, maintenance welding also saves Ford additional thousands of dollars – and many months of waiting.

A 10½-in. diameter hot strip coiler blocker roll was made from seamless tubing 1¼ in.. in wall thickness. The lathe/submerged-arc welder deposited two layers of 5/32-in. 0.65% carbon wire; then two layers of 5/32-in. hardfacing wire.

For the high-carbon wire, current was 425 amp at 25 volts. For the hardfacing wire, it was 350 amp at 25 volts. Welding speed on the 66-in. long rollers was 18 to 20 ipm.

An A-frame bucket, used at the division's dock facilities for handling materials to be fed into blast furnaces, was fabricated from T-1 steel. It replaced a worn riveted bucket. Welding was manual, using E12018 electrodes. Power source was a motor-generator welder.

Some of these savings realized through fabrication cannot be reported with complete accuracy because of time elements involved had Ford had to await delivery.

Drive pinion

A blooming-mill drive pinion, weighing 30 tons, showed during periodic check with dye-penetrant and magnetic-particle inspection that its driving tangs (on both ends) were fractured.

Arc-air equipment was used to gouge the cracks. Tangs were preheated to 600 F and this temperature was maintained throughout welding.

Repairs were made with 5/32-in. and 3/16-in. diameter E7016 electrodes, operating from a motor-generator power source. It took two teams of two weldors each (on three shifts) four days to complete the hot job. Clad in asbestos garments, teams relieved each other every 30 minutes.

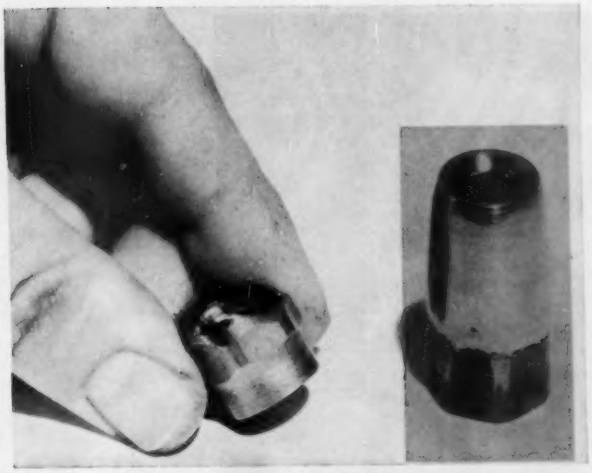
The unit was stress relieved at 1,250 F for 14 hours in a furnace fired with coke oven gas.

Cost: 15% of what a new pinion would cost.

Proper weld procedures and constant vigilance . . . these spell success with a capital $ for the maintenance program at Ford's Steel Division.

And they can spell success for you, too.

With hardfacing material as base metal . . .



WORN glass spray tip (left) and rebuilt tip are compared. Note that face end of worn tip appears undamaged since tip tends to wear through where the air picks up the liquid glass solution.

Rebuilt spray gun tips last 480 times longer

REBUILT WITH A NICKEL-BASE hardfacing alloy as base metal, spray gun tips for liquid glazing glass-lined sewer pipes last 480 times longer.

Originally, low carbon steel tips were used by Clayburn-Harbison Ltd., Abbotsford, British Columbia, to liquid glaze 4, 6, 8, 10, 12 and 15-in. sewer pipe.

The Canadian firm found that as pipe diameter increased, air pressure used in glaze spraying increased and spray tips eroded rapidly.

After 10 minutes of typical operation with these tips, wear was generally enough to distort the spray making it difficult to achieve uniform glaze. After less than an hour, the tip was normally worn through where the air picked up the liquid glass solution.

With two shifts operating, the cost for tips alone was $75 per gun every day. The firm then found that by welding Colomony No. 6 rod on the remaining threaded portion, the spray gun tip lasted six weeks or 480 times longer than the original tip and cost-life ratio showed a net saving of more than 99% in tip operating costs.

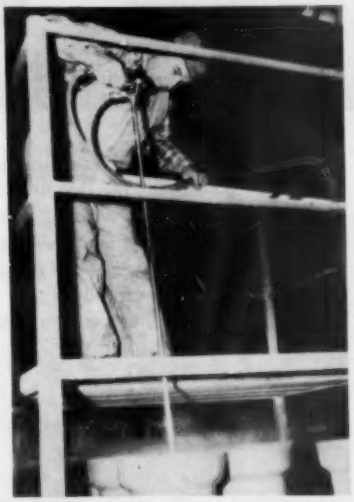
In rebuilding, the threaded hexagonal section of a worn tip forms the reclamation base and standard ⅝-in.-diameter carbon rod is used to produce a mold on which to rebuild. The rod is then machined to be 0.002 in. greater than the threaded portion's inside diameter.

A tool bit ground to exact inside contour is then applied to the lathe-mounted carbon rod. This finishes the mold shape at one end of the carbon rod in about five minutes. The threaded tip portion is then slipped far enough onto the rod to produce desired tip length.

The hardfacing rod is then applied with an oxyacetylene torch tip using the softest neutral flame possible. Working out from the original section, build-up usually requires about 1½ to 1¾ hours.

After the rebuilt tip has cooled, the carbon mold is drilled out and the rebuilt tip is screwed on a threaded piece of ⅝-in.-diameter cold-rolled rod. The mounted tip is put in a lathe and hand finished. The tip is then repositioned in the lathe for inside dressing.

Proper shrinkage control during welding of the tip while rebuilding makes it possible to dress the tip inside and out in about 45 minutes.



OPERATOR sprays liquid glaze on ID of sewer pipe at Clayburn-Harbison Ltd.'s plant in Abbotsford, British Columbia.

USING nickel base hardfacing alloy, operator rebuilds a glass spray tip.

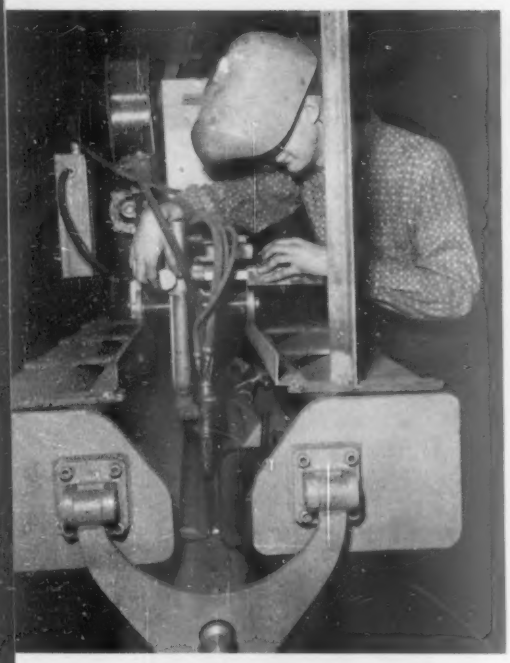


FIG. 1 — Double-bevel butt joints of sheepsfoot drum cylinder are positioned in seamer for welding with CO_2 shielded flux-cored welding process. Carriage travels total of 8 ft at rates up to 30 ipm.

- Maximum use of welding positioners
- CO_2 shielded, self-fluxing welding process

Production line practices speed heavy equipment fabrication

PRODUCTION LINE ASSEMBLY practices, making maximum use of welding positioners coupled with a self-fluxing semiautomatic welding process, are speeding production at Bros Inc., Minneapolis.

The positioning devices are decreasing handling of heavy parts and assemblies and increasing weldor efficiency through more convenient work location.

The welding process, employing flux-cored wire and a CO_2 gas shield, has not only boosted welding speeds, but has also greatly improved weld quality.

A long established manufacturer of packaged and field-erected boilers, Bros Inc. has more recently become even better known as a supplier of road building machinery, especially towed and powered rollers used to compact highway roadbeds.

In a comprehensive production modernization program the company has converted itself from an essentially job-shop type operation to assembly line production.

This conversion, coupled with the addition of labor-saving equipment, has greatly increased production efficiency. Since welding is the company's major production assembly method, improvements in welding practice have been an important factor in the conversion program.

Previously all welding at Bros was performed with the manual metal-arc process. Parts and assemblies to be welded were either positioned by hand or by an overhead crane. Because positioning was difficult, parts were repositioned only when absolutely necessary and, hence, much welding was done awkwardly and out-of-position, substantially decreasing efficiency.

Among the positioners now being used by the firm are standard and modified models, as well as special units of Bros design.

Some are equipped with fixtures to make the particular welding operation virtually automatic. Others increase the efficiency of the manual weldor by locating the work in more convenient positions. All have contributed to improved welding rates.

The semiautomatic welding process selected by the firm's production engineers for the bulk of production welding on the equipment line is National Cylinder Gas Div.'s Dual Shield.

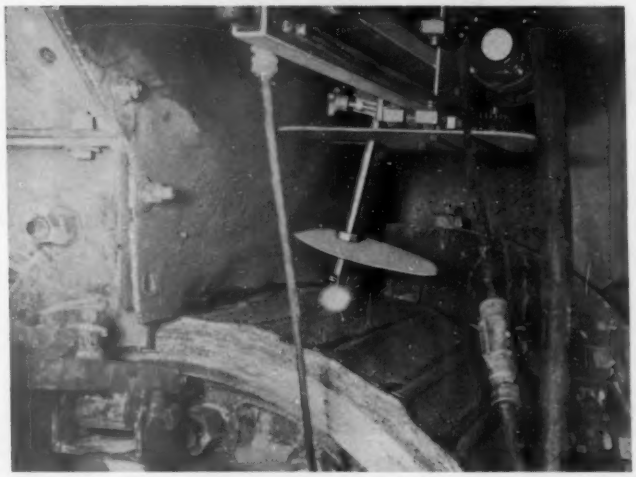
The process not only permits much higher welding speeds than manual metal-arc welding, but it is simple to operate, usually requires less joint preparation and produces an easily cleaned weld.

Using flux-cored wire, the proper amount of flux

FIG. 2 — Stationary, vertically-mounted gun welds drum end plates to cylinder which is mounted on rollers at 45 deg angle and rotates at 10½ ipm.

Announcing **3** **NEW STOODY**

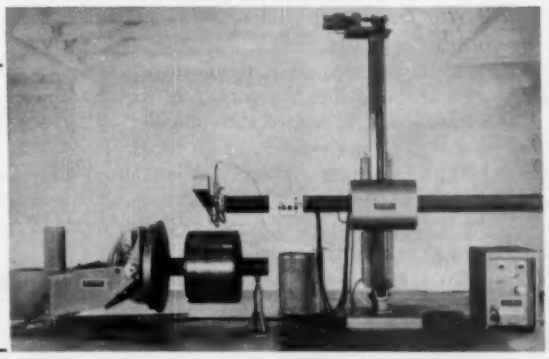
Automatic Welding Systems!



Stoody has long been the recognized leader in alloy wires for automatic hard-facing as well as for hard-facing rods and electrodes. No other manufacturer offers equal experience or a product line so versatile and complete.

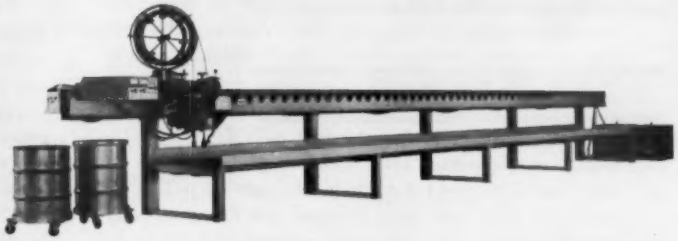
Now Stoody augments the best hard-facing materials available to industry *with a whole new line of automatic welding machines* covering specialized and general needs. Before investing in any automatic welding machines check with Stoody . . . pioneers and developers in the field of hard-facing, *manufacturers of the latest designs in AUTOMATIC WELDING SYSTEMS!*

1 **STOODY CRUSHERMATIC**—A compact, versatile system for automatically rebuilding and hard-facing crusher rolls in position. It enables the welder to work outside the crusher chassis in comfort and clean air. The Crushermatic consists of a motorized carriage riding a track which is suspended over the crusher roll. Wire is supplied to the carriage by any standard semi-automatic wire feeding unit. Uses a 400 amp power supply but 600 amps are preferable. Versatile electronic controls provide proper sequencing for a *variety of circumferential and transverse welding patterns.* The Crushermatic is portable by one man and is slipped into permanently welded brackets when in use. *It deposits up to 20 lbs. per hour—300% to 400% faster than manual welding and 200% faster than hand-held semi-automatic welding.*



2 **STOODY MODEL U W UNIVERSAL AUTOMATIC WELDER**—The Model U W provides a complete welding system capable of cylindrical, conical and straight line welding. The 3000 lb. capacity positioner *tilts the workpiece through a 120° angle and is equipped with power elevation and thyratron controlled rotation.* All electrical controls are unitized in a *portable control panel* for maximum operator convenience. *Ram type manipulator* has a vertical travel from 6" to 8'-6"; Horizontal travel: 10'; Travel speed range: 5 imp to approximately 60 ipm. Manipulator mast *rotates through 360°.* Power source: *DC, constant potential selenium rectifier type.* Input: 220-440 V, Output: 500 amps at 40 V 100% duty cycle. 5 point slope control.

3 **STOODY MODEL T L DUAL-HEAD TRACK LINK WELDER**—Provides dual welding heads with wires supplied from twin Payoffpaks for fast, efficient rebuilding and hard-facing. Extremely rugged construction. Features: *Special gear-type wire feed rolls; positive high frequency starters; wider, lower bed for easier accessibility and greater capacity; heavy-duty double worm reduction gear box with DC variable speed travel drive motor. Unitized control panel.* Bed length 40'; Bed width 46"; Bed height only 24"; Power: 2-500 amp constant voltage 100% duty cycle 220-440 V power sources.



• *For full information on all STOODY AUTOMATIC WELDING SYSTEMS see your Stoody dealer (check the Yellow Pages of your phone book) or write direct.*

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Visit our booth at the welding show. New York City, April 1961

For more facts Circle No. 165 on Reader Service Card

reaches the joint along with the weld metal. A process control unit determines wire feed rate, and the shielding gas and water coolant flow rates to the welding gun. Feed and flow rates are preset, so all the weldor has to do is strike the arc.

Two types of welding setups are in use on the heavy equipment line. For manual semiautomatic welding the power source, control unit, CO_2 cylinders and water tank are mounted on rubber-tired dollies so that they may be moved to the work.

At the fully automatic stations, equipment is positioned permanently. All the units are powered by 220 volt a-c power sources rectified to constant d-c voltage. Reverse polarity is used in this operation. In all, the company is using 16 of these welding units and plans to install more.

An example of how positioners and the CO_2 process were put to maximum use can be seen in the fabrication of one piece of heavy equipment for highway compacting.

Sheepsfoot roller drums are entirely welded on semiautomatic positioners. The 40-in.-diameter drums are made of 9/16-in.-thick mild steel plate. After rolling, the cylinder is welded on the seam welder as shown in figure 1.

The seamer has copper back-up and jig plates for positioning the joint. The control unit and gun are mounted on a motorized carriage which has a total travel of 8 ft at speeds up to 30 ipm.

Drum end plates are automatically welded in place with a ½-in. fillet weld on a roller positioner. As on the seamer, the automatic gun is mounted vertically, but in this case is stationary and the drum rotates beneath it at 10½ ipm.

As shown in figure 2, the drum axis is 45 deg from vertical. With the gun positioned directly above the bottom point of the rotating circular joint, the weld is in the proper position at all times.

With manual metal-arc welding, drum ends were welded in 2½ hours, while the new technique joins drum ends in 50 minutes and provides welds of more consistent quality as well.

After the drum has been completed, the forged steel feet are welded to the cylindrical wall. Again the CO_2 flux-cored process is used, but in this case manually as shown in figure 3.

The roller has 112 of these feet. With the drum mounted on its axis for easy hand rotation, the feet are tacked in position with a spot welding attachment to the welding gun.

Complete assembly of the feet calls for a circular ⅜-in. out-of-position fillet weld around the base of each foot. This weld is made in two parts: one-half on each foot from one side, rotating the drum to position the joints; then reversing position and completing the welds around the base from the other side.

Previously with the manual metal-arc welding process, this weld had to be made in two passes to attain sufficient penetration. The CO_2 shielded semiautomatic process provides enough penetration for a single pass **(figure 4).**

FIG. 3 — Roller feet can be welded to drum with semiautomatic unit in one pass because of greater penetration.

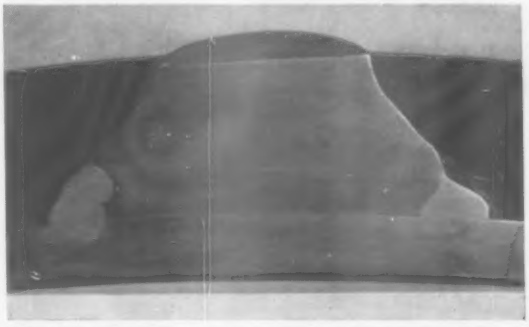

FIG. 4 — Etched cross-section of joint between foot and drum compares single pass of CO_2 process (right) with that of two-pass manual metal-arc weld.

Overall time savings in sheepsfoot roller production as a result of the new techniques are estimated to be about 50%. Improved quality is another plus value of the new methods and substantially less remedial work is necessary.

Weld quality is important since the drums are water-filled to obtain the necessary weight for compacting highway subgrades. After completion, rollers are hydrostatically tested.

Although these rollers are towed, Bros Inc. also makes self-propelled, wheeled rollers whose bodies are essentially large open steel-plate hoppers.

Such a 12-ton roller body is also welded with the semiautomatic equipment. The unit is made of 3/16-in. mild steel plate joined with more than 1,000 in. of welds, most of them ¼-in. fillets.

A specially designed positioner allows all welding to be done in the downhand position. This factor, combined with the increased deposition rate of the welding process, has cut body production time by an estimated 30%.

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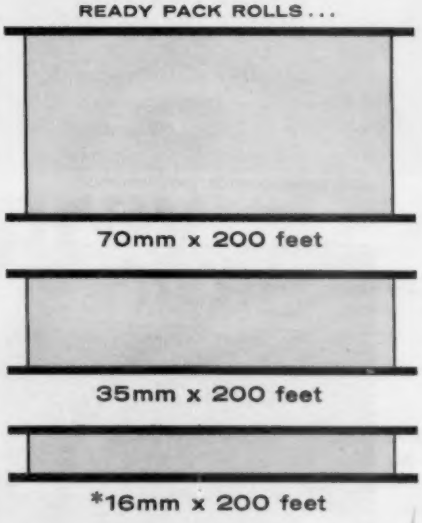

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WE visits the Plant Maintenance Show

THOUSANDS OF PLANT MANAGERS, superintendents and maintenance men braved Chicago's sub-zero weather in late January to attend the annual National Plant Maintenance & Engineering Show.

Included among the more than 400 exhibits at the International Amphitheatre were numerous welding and allied equipment displays, some of which are shown on this page.

In conjunction with the show, 36 speakers presented papers ranging from welding in maintenance to evaluation of plant engineering and maintenance performance.

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New Aircospray is so versatile and inexpensive that it may well be tomorrow's most profitable metal-to-metal surfacing process.

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A wide variety of powdered metals and alloys have been applied successfully. These include — Aircolite hardfacing material for severe abrasion and moderate impact on farm implement equipment and Aircolay 6N for medium impact and corrosion and abrasion at elevated temperatures. These alloys are also available with tungsten-carbide for improved wear resistance.

Airco #27 alloy for the brazing of steel, cast iron, brass or bronze provides a bronze braze excellent on tubular furniture (a gas flux must be used).

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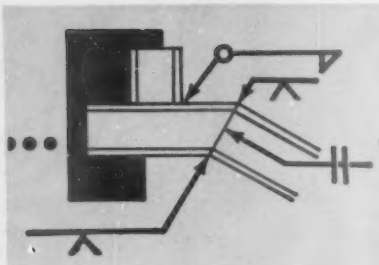


the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Another method for welding plastic

Question:

In your August 1960 clinic, you explained hot gas welding of thermoplastics. Is there any other way of welding thermoplastics?

Answer:

Thermoplastics can be welded by electrically heated compressed air or nitrogen. There are three basic types of plastic welding by this method: tacking, hand welding, and high-speed welding.

Each type requires different tips or high-speed tools, according to Kamlar Products Co., Norwood, Mass. These tips and tools are mounted individually on the manual compressed-air welder. By changing tips or tools, different type welds can be accomplished.

Before welding, however, pieces must be cut into proper shapes. For welding butt joints, the best bevel angle is approximately 30 deg for each piece for a total 60-deg angle. Internal corner sections should be beveled to 45 deg.

Leave no sharp edges. Remove dust and use no solvent.

The purpose of tacking is to hold pieces to be welded in place. Tacking eliminates additional manpower, clamps or jigs.

To tack weld, screw tacking tip into end of the barrel and set air pressure at about 3 lb. Hold welder firmly at about an 80-deg angle with tip point touching material on joints.

Then make short, quick tacks by placing tip on the joint and tacking at intervals. Welder can then be drawn along entire joint for continuous sealing.

Basic tack-welded material is now ready for further welding.

Hand welding is recommended when difficult areas such as corners, short runs, and small radii are to be permanently welded in a desired position. Fusion is achieved by proper heat and pressure.

To hand weld:

1 — Insert round tip for use with welding rod, or flat tip for use with plasticized strips.

2 — Set air pressure at 3 lb.

3 — Hold welder in one hand and rod or strip in other hand.

4 — At start of weld, place tip about ½ in. above base material at 45-deg angle.

5 — Move tip in fanning motion along area to be welded. A few motions will preheat base material.

6 — Place welding rod end on preheated area and continue fanning motion along base material and lower end of welding rod.

7 — Apply gentle pressure to rod. Hold rod at slight backward angle and push towards tip only as fast as rod softens and welds. Maintain fanning motion and do not push too hard or rod will stretch giving a flat weld.

8 — Weld can be stopped at any place by moving welder away and continued again by using starting procedure already cited.

9 — After weld is completed, set welder aside, cut rod with knife or cutting pliers close to base material.

High-speed plastic welding incorporates basic hand-welding methods into specially-designed tools.

High-speed welding is possible because rod and base material are preheated in a tube while base material is preheated by a hot-air stream from a vent in the underside of the tool.

A shoe on the end of the tool furnishes needed pressure and smooths the rod for uniform appearance and high tensile strength. Once started, the rod is fed automatically into the preheating tube by the motion of the welder being pulled along the joint.

To high-speed weld:

1 — Select and insert proper size high-speed tool for round rod.

2 — Set air pressure from 3 to 5 lb., depending on welder.

3 — Grasp welder firmly and hold upright ¼ in. above base material over starting point of weld.

4 — Immediately insert welding rod into rod-tube and push rod downward slowly until rod rests on base material.

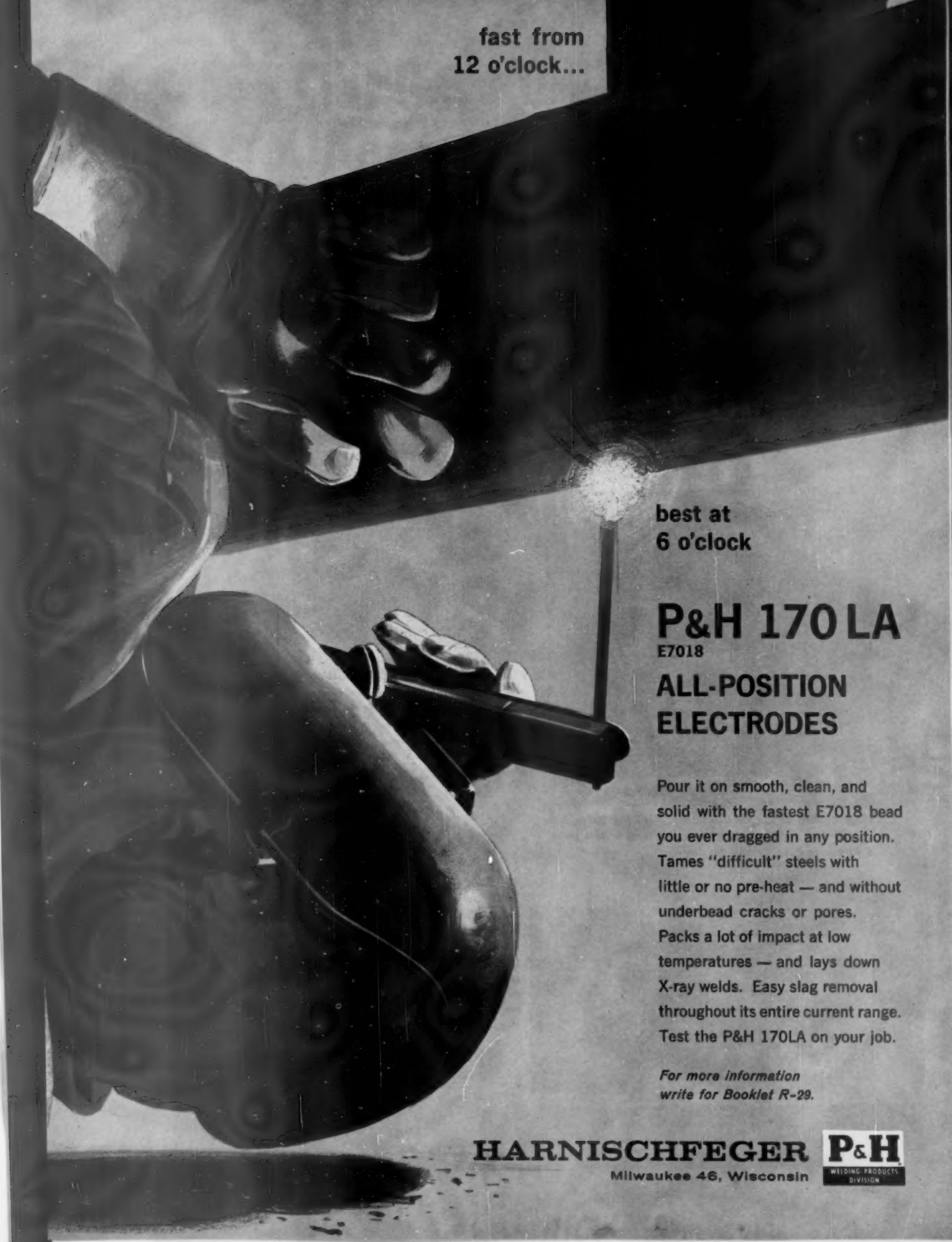
5 — Increase downward pressure on rod which will then bend. Shoe will rest on top of rod.

6 — Pull welder with slight downward pressure in direction of weld. At the same time, lower angle of welder to about 45 deg and proceed with weld. (If weld progress is too slow, weld area will discolor; if too fast, flowlines along rod will not appear.)

7 — While progresing with weld, always watch welding rod at end of shoe. At that point, weld should show slight uniform flow lines along both sides of rod without any discoloration or burning.

8 — At end of weld, cut the rod (a) by pulling back welder and letting rod run through tube and then cutting rod at end, or (b) by bending welder quickly to upright position and then pushing down on point of shoe and pulling rod out with the other hand so point of shoe will cut off rod.

For more facts Circle No. 168 on Reader Service Card →



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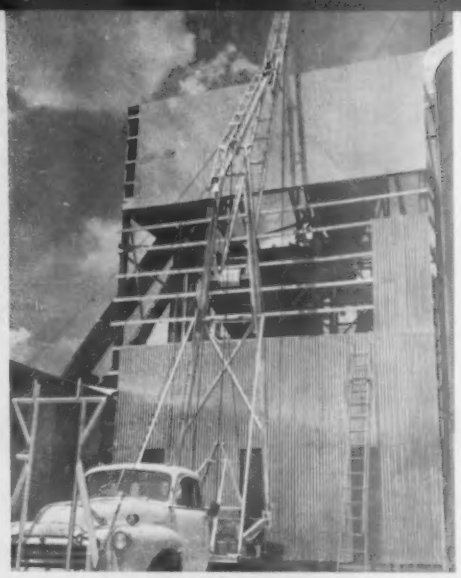
Welding on the farm

by A. M. Wettach

On the farm, as anywhere else, proper welding can lead to savings and profit. Good welding technique and thought led to these welding ideas which have already shown their worth.



FOLDING DERRICK was welded to fit on an old truck bed. The portable, retractable derrick is fabricated from heavy pipe, bar joints and angle iron and designed for lifting construction material — such as this siding on a feed mill and grain elevator.

HOG-SORTING unit consists of three welded pipe gates with welded sheet metal panels. By means of these welded gates, a farmer can rapidly sort his hogs.

TRACTOR-DRAWN high-clearance row crop sprayer is farm-shop constructed and welded. Chassis is composed primarily of angle iron and pipe. Two 55-gal steel drums are mounted on it and connected by plastic hose to booms on both sides and to hand sprayers mounted on the tongue. Power take-off unit of tractor operates the sprayer rotary pump.

SCRIBER is handy for marking overhang on curved roofs. Welded from light scrap iron, it is adjustable by means of a set screw. "T" fits against the side of the building and overhang can be marked at any set length.

JOINTER, mounted on a welded iron frame for greater mobility, saves valuable time. Other farm shop equipment can also be mounted on welded frames for easy transportation.

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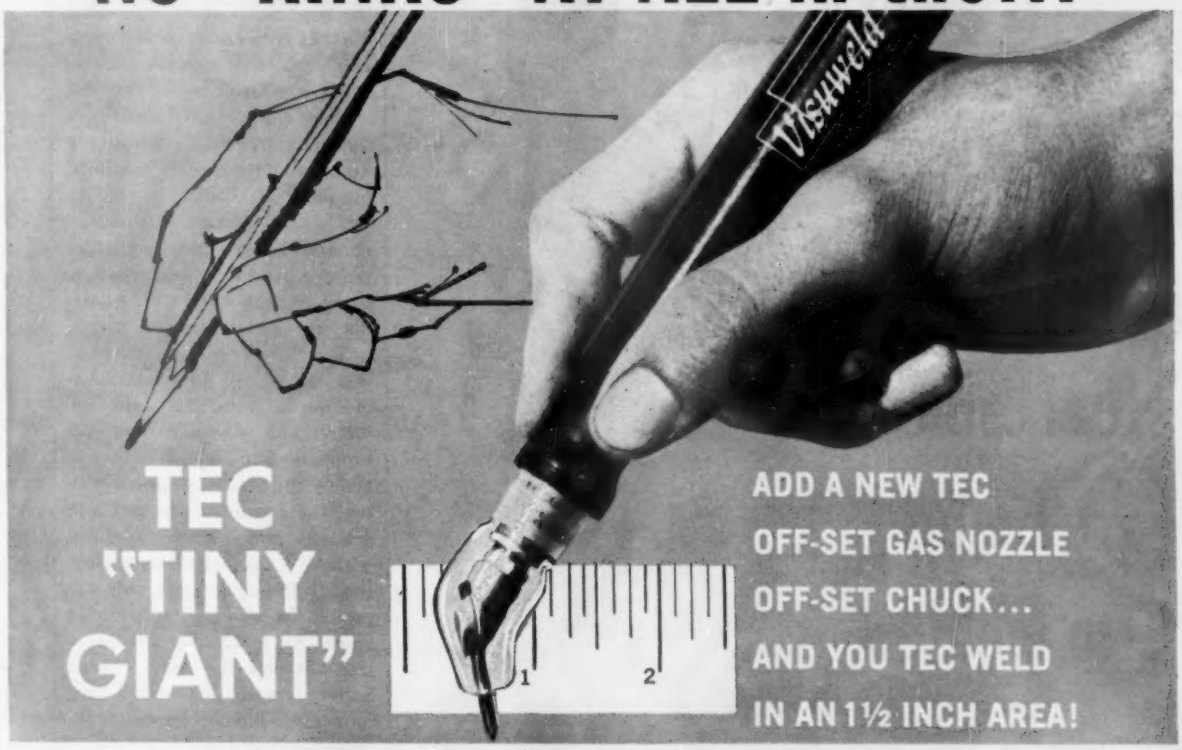
NO "KINKS" AT ALL in the...



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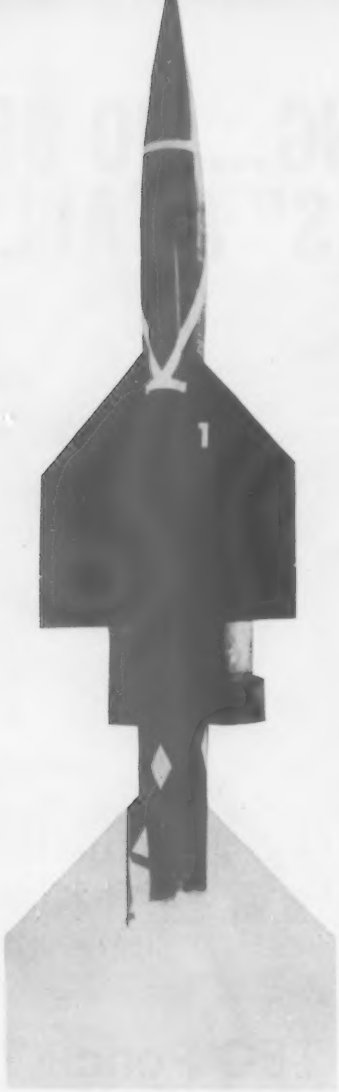
Missile's aluminum fuel tanks are being Tig welded



Cracks in missiles can be costly

UNLESS IT IS LOCATED and properly evaluated, a tiny crack can cause a massive missile to fail.

Such crack evaluation is now becoming possible, according to Stanford Research Institute, Menlo Park, Calif.

The large size and design complications of today's missiles require handling which may introduce small cracks at, or under, the metal surface.

The crack-creation problem was solved by first spark-machining a thin slot into the metal. The specimen then was dropped into liquid nitrogen. When the liquid stopped boiling, the specimen was put into a holder and a steel stud fired with a blank cartridge against the steel sheet on the side opposite the slit to produce the crack. By machining the same size slit and the same charge bullet, crack dimensions are now reproducible for test confirmation.

Aerojet-General Corp. sponsored the Stanford project.

TIG-WELDED FUEL TANKS for the new Bomarc B defense missiles are being made with a strong, heat-defying aluminum alloy — 2219.

The new missile (with twice the range, greater speed and improved reaction time over the earlier Bomarc Model A) is being manufactured by Boeing Airplane Co., Seattle, Wash. The Alcoa aluminum alloy's application in a combination fuselage section and fuel tank constitutes its intial use in a major welded structure.

Boeing fabricates each 35½-in.-diameter, 72-in.-long tank by welding aluminum alloy sheets to seven aluminum alloy rings. The units are Tig welded with 2319 aluminum filler wire.

The Bomarc B will fly higher, farther and faster than any missile now guarding this continent. To achieve the expanded capabilities demanded by the Air Force, Boeing switched from a liquid to a solid-fuel rocket-engine booster for launching Bomarc. This increased the fuel space available for two ramjet engines which power the missile after booster burnout.

Boeing engineers then selected the aluminum alloy as a lightweight tank material to afford the high strength needed to carry fuel under pressure and to serve as a load-carrying structure for missile wings and power plants.

COMBINATION fuel tank and fuselage section for new Bomarc B defense missile is Tig welded by Boeing Airplane Co. welder.

WELDED STAINLESS INTERIOR— KEY TO VITAL HIGH-PURITY SYSTEM FOR DRESDEN REACTOR

43,000 pounds of stainless electrodes and wire protect nuclear system from corrosive impurities

Dresden Nuclear Power Station, near Chicago, is one of the first installations to use nuclear energy for commercial purposes. Vital to its operation is the maintenance of a high degree of water purity. The extensive use of stainless steel in the reactor keeps the unit as free as possible from corrosive elements which would lower this purity level.

The weld-clad interior of the reactor vessel required in excess of 43,000 pounds of stainless steel electrodes and welding wire. New York Shipbuilding Corporation, Camden, New Jersey, fabricators of the vessel, used ARCALOY Stainless Steel Electrodes for manual cladding and welded joints. Alloy Rods Company Bare Stainless Steel Welding Wire was used for submerged arc cladding.

When job standards demand the ultimate in stainless steel weld metal, discerning fabricators rely on the high quality products of Alloy Rods Company, the world's largest producer of stainless steel electrodes and welding wires. Call in your Alloy Rods' Representative or Distributor on your next stainless fabrication. He has knowledge and products to improve the quality of your welds . . . on any of the weldable grades of stainless steel.

Distributors, warehouses and representatives are located throughout the country for intelligent and efficient servicing of all your stainless welding requirements. For information, write to Alloy Rods Company, P. O. Box 1828, York 2, Penna.

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YORK, PENNSYLVANIA

SALES OFFICES & WAREHOUSES; BOSTON, NEWARK, PHILA., PITTSBURGH, BIRMINGHAM, CLEVELAND, CHICAGO, SAN FRANCISCO & EL SEGUNDO, CAL.—DISTRIBUTORS IN ALL OTHER PRINCIPAL CITIES

TWENTY YEARS OF LEADERSHIP IN THE DEVELOPMENT OF QUALITY ALLOY ARC WELDING ELECTRODES

For more facts Circle No. 170 on Reader Service Card

Large and Small Fabricators of steel and ornamental iron - swear by it . . .

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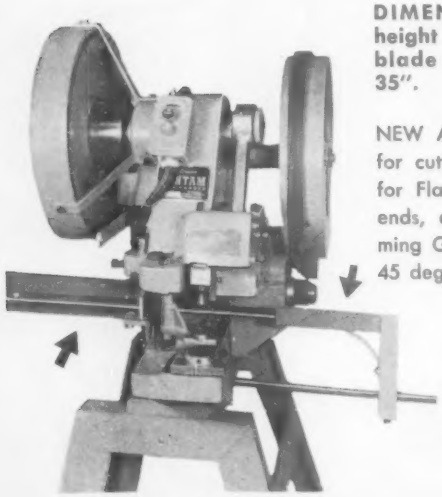
BATEMAN BANTAM IRON WORKER

The Only Iron Worker of its Kind on the Market Today!

This machine is designed for both the large and small fabricators of steel and ornamental iron. The operator who owns a large iron worker cannot afford to operate the expensive machine on small cutting and punching when the Bantam will do it faster and cheaper. The Bantam cuts and punches fast and clean . . . no grinding necessary. It's versatile, and saves time and labor! Cuts 2" x 2" x 1/4" angle and 1/4" x 4" flats.

Punches 1/2" hole through 1/4" material. Operates by hand or foot, uses 3/4 hp motor (1750) rpm., powered with flywheel and drive gear.

The Coper will cope 1-1/4" through 1/8" material.



DIMENSIONS – Overall height 56" floor to shear blade 36", width 24" x 35".

NEW ACCESSORIES: Gauge for cutting to length, Guide for Flat Bars for cutting on ends, and Angle Iron Trimming Guide, for cutting at a 45 degree. Write for details.

BATEMAN BANTAM IRON WORKER, with motor and stand $575.00

Price does not include Blades, Punches or dies.

Shipping Weight .....750 lbs.

BLADES, PUNCHES and DIES at list price,

NOTE: Please specify Single or Three-Phase motor.

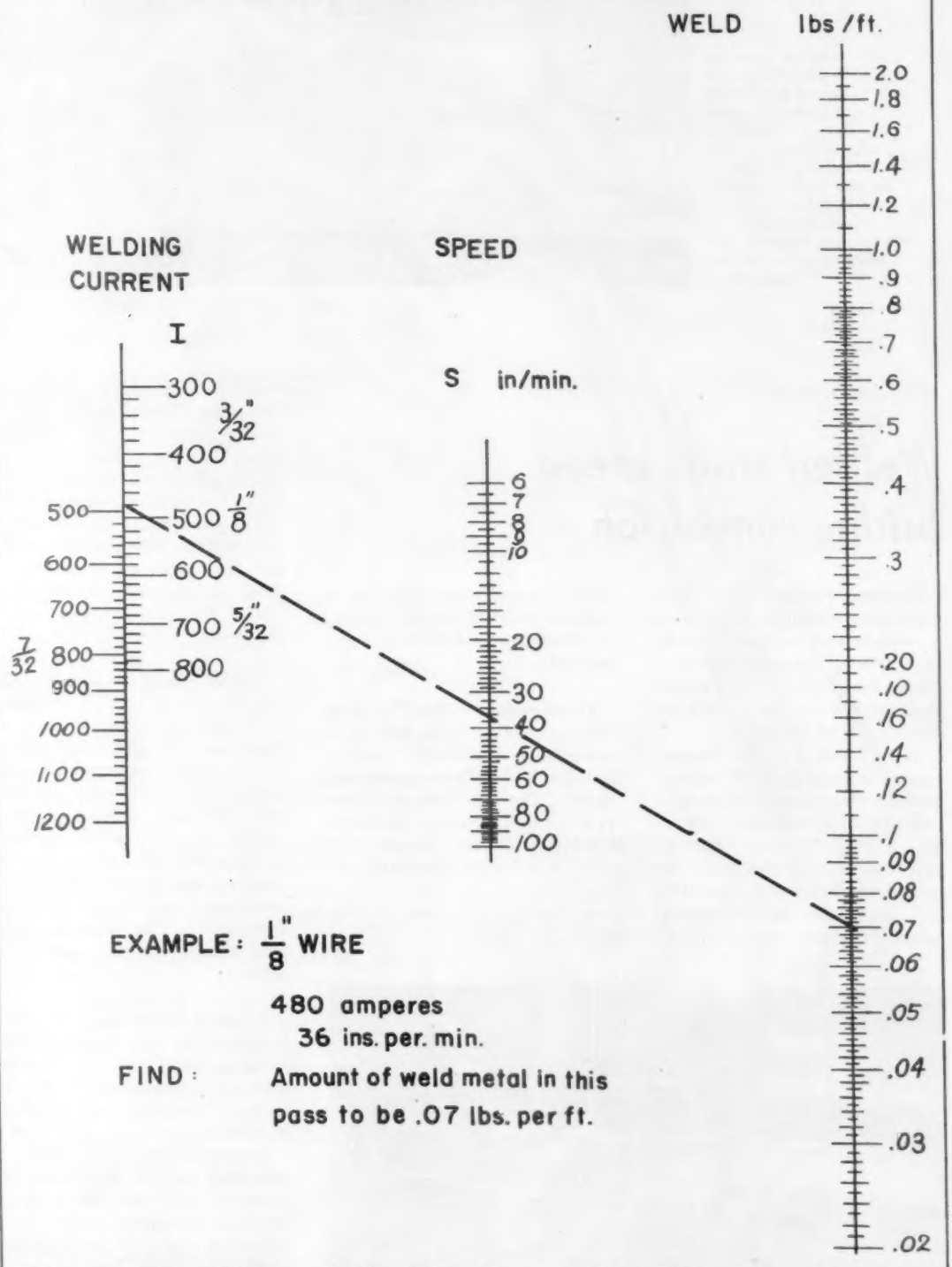
OUR 52nd YEAR

Write for complete information and name of the distributor nearest you.

Bateman Foundry & Machine

MINERAL WELLS, TEXAS

Determining deposited weld metal



This nomograph can be used to find the amount of weld metal deposited for any given pass of an automatic weld, using electrode positive. Use nomograph for each pass; the total of all passes should equal the required amount for the joint.

Courtesy Lincoln Electric Co.

STUDS are seen placed in steel beams in one stage of upgrading of bridge at Blue Island, Ill. It was necessary to replace the concrete slab roadway, and by bonding the slab to the steel girders, vibration and deflection were reduced. One-half of the bridge remained open while the other half was being built.

by the late V. M. Romine*

Welded studs speed bridge conversion

COMPOSITE CONSTRUCTION, utilizing welded studs in replacement of a concrete slab roadway, recently made possible the conversion of an Illinois bridge to provide a greater load-carrying capacity at little additional cost to the state.

The 1,500-ft Burr Oak Avenue viaduct in Blue Island, Ill., was upgraded with composite design from an AASHO (American Association of State Highway Officials) load rating of H18-S15 to the equivalent of H20-S16. (An H18-S15 rating refers to load-carrying capacity for traffic up to trucks of 18-ton capacity with 15-ton semi-trailers; H20-S16 means capacity for 20-ton trucks with 16-ton semi-trailers).

Deterioration of the 7-in.-thick roadway was the main reason for reconstruction, although vibration and live load deflection were also factors. The steelwork was considered structurally adequate. Bonding of the new concrete slab to the steel beams considerably reduced the vibration and deflection.

If it had not been necessary to replace concrete, it probably would have been more economical to upgrade by welding cover plates to the bottom flanges of the beams.

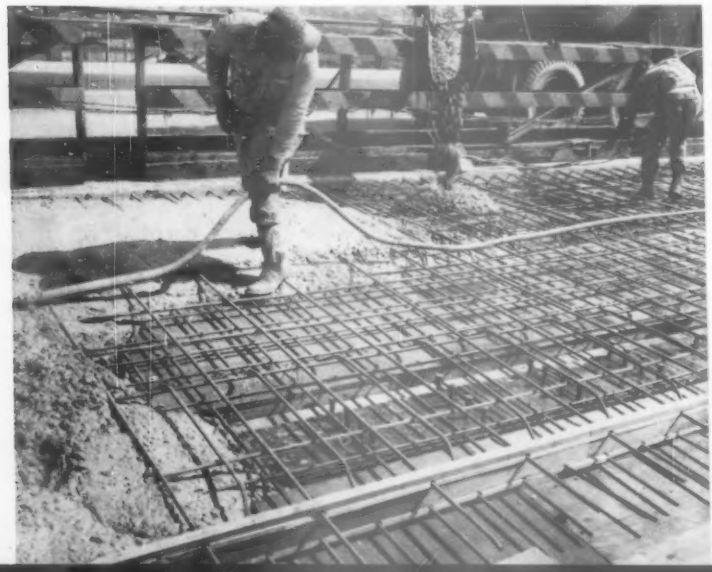
The plates would have increased steel stiffness but probably would not have reduced vibration as much as composite construction. Under the circumstances, cover plates were not used.

Headed shear connector studs 4-in. long and ⅞-in. in diameter were used in design because of their speed of application. Selection of this type of shear — manufactured by Nelson Stud Welding Div., Gregory Industries, Inc., Lorain, Ohio — greatly reduces the possibility of warpage in the structural members sometimes encountered when prolonged arc time is required in fillet welding structural shapes or other type connectors.

A total of 24,160 studs were end-welded to the upper flanges of the bridge girders. Placed four in a row with rows approximately 6- to 18-in. apart, the studs were installed at a rate of about three per minute.

In addition to rapid speed of placement and the elimination of distortion, use of end-welded studs simplified installation of the shear connectors near rivet heads on the plate girder spans.

Mr. Romine was Engineer of Bridge and Traffic Structures for the Illinois Division of Highways.



HERE, concrete is poured onto the beams, welded studs, and reinforcing rod. Bonding of concrete to steel raised load capacity of bridge considerably.

THIS TORCH SAVES MONEY

What an easy way to reduce those high maintenance and repair costs, to eliminate time loss due to damaged torches!

Liquidweld cutting torches are designed to withstand plenty of rugged treatment. But, like any piece of mechanical equipment, they are subject to accidental damage and eventual service wear.

This is where Liquidweld saves you money —because, if damage should occur, you don't need a repair shop.

Should a Liquidweld head seat be damaged, just reach in your Liquidweld do-it-yourself repair kit and select a replaceable mixer sleeve. Drop it in your torch and it's ready to go to work again.

Results: *no repair bills, no excessive loss of use-time!*

For complete information on torches and regulators that are as perfectly balanced as the finest rifles—yet economically priced—send in the coupon for new, complete catalog.

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For more facts Circle No. 172 on Reader Service Card

SPECIALLY-developed techniques are applied in Tig welding forged Inconel tube sheets and seamless Inconel tubing in internal circuit heat exchanger. The exchanger, designed by American-Standard Industrial Division, Buffalo, removes heat generated by spent nuclear reactor fuel elements.

On the job . . .

WELDOR tack welds side seam of water softener tanks for General Ionics Corp., Pittsburgh. Using Types 302 and 304 nickel-stainless steel, the firm has produced over 25,000 units with almost no corrosion failure.

USING three stud-welding guns to weld 120,000 ⅜-in. studs to the open grid decks of the Lake Washington Floating Bridge in Seattle, workers created a highly-tractional surface to prevent skidding in wet and icy weather. Both guns and studs were made by the Nelson Stud Welding Division of Gregory Industries, Inc., Lorain, Ohio.

TIG welding is used to join leg bracket to stainless steel tubing grading ring section fabricated by Republic Steel Corp., Cleveland. Rings will be used to shield and grade insulator string to prevent corona and flashover formation from antenna system of the Navy's 2,000,000-watt radio station constructed last month in Cutler, Maine.

IMPROVE INSPECTION EFFICIENCY WITH ANSCO MONOPAK X-RAY FILMS

Modern non-destructive testing requirements call for fast and accurate flaw detection. That's why experienced technicians depend on Ansco Superay® 'A' and 'B' Monopak X-ray films . . . for quick and positive readings. Take advantage of the dependability and ease-of-handling convenience offered by Monopak. For information about how Monopak can improve your inspection efficiency write: Ansco Industrial X-ray Department, Ansco Division, Vestal Parkway East, Binghamton, New York.

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NEW

Mid-States Power-Tran

180 Amp. Welder
Farm Shop Equipment

★ **Wide Range**
15-180 Amps in 15 steps. Will weld light and heavy gauge materials 1/16" thru 3/16" rod.

★ **Full 80 Volt Open Circuit Voltage**
Means you can weld with all types of rods — stainless, cast iron, hard surfacing, low hydrogen.

★ **5 Year Burn Out Proof Guarantee**
Proves high quality of components. Your assurance of the best welder available!

★ **Volt-Arc Balancing Net Work**
Voltage automatically adjusts for light gauge materials and gives dense, deep penetration on heavy metals.

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Simplifies current settings — accurate and positive values each time.

★ **Heavy Duty Wheels**
Highly mobile — Use it anywhere in the shop or barn.

★ **No Moving Parts**
Transformer designed for connection cooling — No fans that require oiling — no maintenance.

★ **Extra Bonus**
Built in "EYE APPEAL." Modern, attractive and follows the same design as the famous MAGNA-TRAN.

★ **Cam-Lok Plugs**
For positive fit — Can't pull out.

Built to NEMA, REA and UL Specifications for your protection

VISIT OUR BOOTH 233 AT AWS WELDING SHOW APRIL 18-20

Mid-States Welder Mfg. Co.
6025 S. Ashland Ave., Chicago 36, Ill.

Circle No. 174 on Reader Service Card

300 weldors help to build new generating station

OVER 300 WELDORS combined their efforts recently to help produce a new $110 million generating station in New Jersey.

The Bergan Generating Station, a 580,000 kw capacity addition to the Public Service Electric and Gas Co., is located on Overpeck Creek and Hackensack River adjacent to the New Jersey Turnpike at Ridgefield, N. J.

For the various piping systems in the station, over 16,500 field welds per unit were required. Of these, 4,000 welds (¼ of which required radiographic inspection) were made by inert-gas welding in one pass.

The entire all-welded main steam piping system of the plant was made with type 316 austenitic stainless steel. Tubes in the high-temperature sections of the superheater were made of seamless, coldworked type 321H and 316 austenitic stainless steel heat treated to a minimum temperature of 2,000 F to improve creep-rupture properties. Alloy welds were involved in 15% of the weld electrodes for these high-temperature sections.

Joints in the main steam, hot reheat and boiler feed piping system were made without backing rings. In these joints, the root pass was made by inert-gas welding. All joints, except those of the main steam system, were heat treated after the weld was completed.

The field-welded joints in the main steam system were not heat treated.

Main steam pipes are 11¾-in. OD, schedule 100; hot reheat pipes are 16-in. and 20-in. OD, schedule 100; and boiler feed pipes are 8-in. and 10-in. OD, schedule 160.

Condenser cooling water for the plant's generator runs in 60-in. and 72-in. pipes made of reinforced concrete containing an embeded thin-steel cylinder. Joints of this cylinder were welded and filled-in with reinforced grout to give a smooth surface on the inside of the pipe.

Welding was also used in another phase of plant construction. The exterior platforms around the boilers and some interior platforms of the plant consist of single-span, reversible steel grating laid between steel stop bars welded to the top of supporting beams.

The 110-acre plot on which the plant is built was originally marshland. Nearly 860,000 cu yards of sand and gravel were needed to fill the land. With the aid of bulldozers, power shovels and a railroad, a mountain outside of Newburgh, N. Y., was moved to the site to provide fill.

INTER CHANGE ABILITY

FOR PROTECTION-PLUS IN SOFT AND RIGID GOGGLES

Do you know you can switch retainer rings, cover plates, lenses, straps—even eyecups—throughout the Bausch & Lomb line of chippers' and welders' goggles and plate holders?

This interchangeability spells protection, economy and worker comfort. No need to retire a whole unit if a retainer ring is damaged, nor waste dollars on new lenses when new cover plates are readily available to prevent scratching and pitting. Spare parts for one B&L goggle type fit precisely all the other goggle types—soft or rigid. Sliding plates are interchangeable between chippers' and welders' plate holders making either convertible. Workers are always wearing equipment in tip-top condition, with the utmost visual and fitting comfort.

This is the Protection-*PLUS* line. Eye protection built to *last*—with parts always replaceable and interchangeable. For more information, call your supplier, or write for details, catalogs: Bausch & Lomb Incorporated, 98715 Bausch Street, Rochester 2, New York.

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For more facts Circle No. 175 on Reader Service Card

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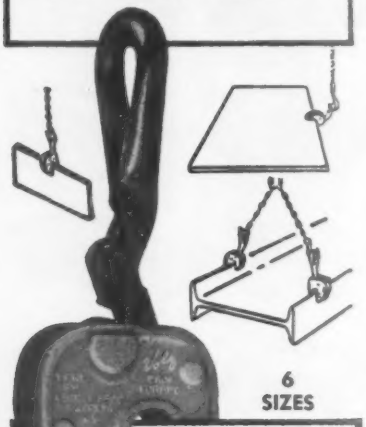
with MERRILL
MATERIAL HANDLING
DEVICES FOR THE MOST
IN Safety and Economy

Imitated, but never duplicated. Merrill Lifting Clamps are Drop Forged to give you Safety in Handling and Economy in Operation.



6 SIZES

FEATURING THIS MONTH

HORIZONTAL PLATE CLAMP
Rated capacity — 3 ton (6 tons per pair). Completely drop forged . . . Heat treated.

Over 25 Material Handling Devices described in our catalog C-3.

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Producers of Drop & Press Forgings
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Circle No. 176 on Reader Service Card

With a propane torch and some solder . . .

YOU CAN BE A COATHANGER SCULPTOR

WITH FOUR COATHANGERS, some flux-core solder, pliers and a propane torch, you can make an "Easter Angel" candlestick or a "Stutz Bear Cat" letter holder in one evening.

Start by clipping the wire on both sides of the spirals that form the coathangar hooks. Straighten and remove the bends. This will give you about 31 in. of usable metal.

Holding a wire end with the pliers, run the torch flame slowly along the metal. This makes the black enamel easier to rub off with steel wool, and softens the wire for effortless forming.

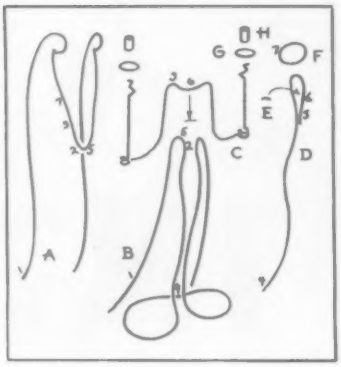
The "Easter Angel" candlestick has five wire units. When shaping A, B and C (see diagram), start at the center of each wire and make corresponding bends alternately to insure symmetry.

Fixed dimensions are not important, but A should be about 8-in. high; B should be about 5-in. high; and C about 5-in. wide.

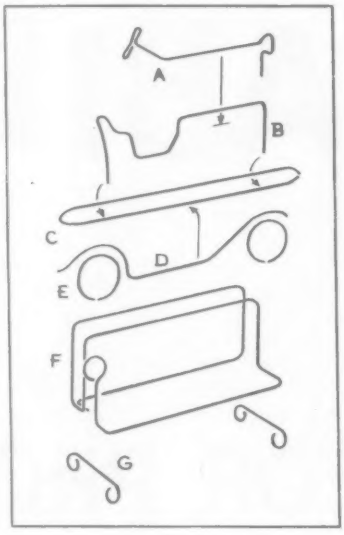
With a propane torch, such as the Bernz-O-Matic, first solder A to B at points 1 and 2. Then solder C across the outer face of A at point 3. Next attach D to A and B at point 5 and to C at point 6. Attach the sides of the halo (F) to the inner surfaces of the wings (A) at point 7. Finally, apply the small cross member (E) to D.

Bases of candle holders (G) are half-inch washers. Holders can be made of empty .22 cartridge or rolled brass stock. Apply a coat of flat black enamel to the finished assembly. For an antique bronze finish, follow with a spatter-coat of pale green.

"Easter Angel" candlestick

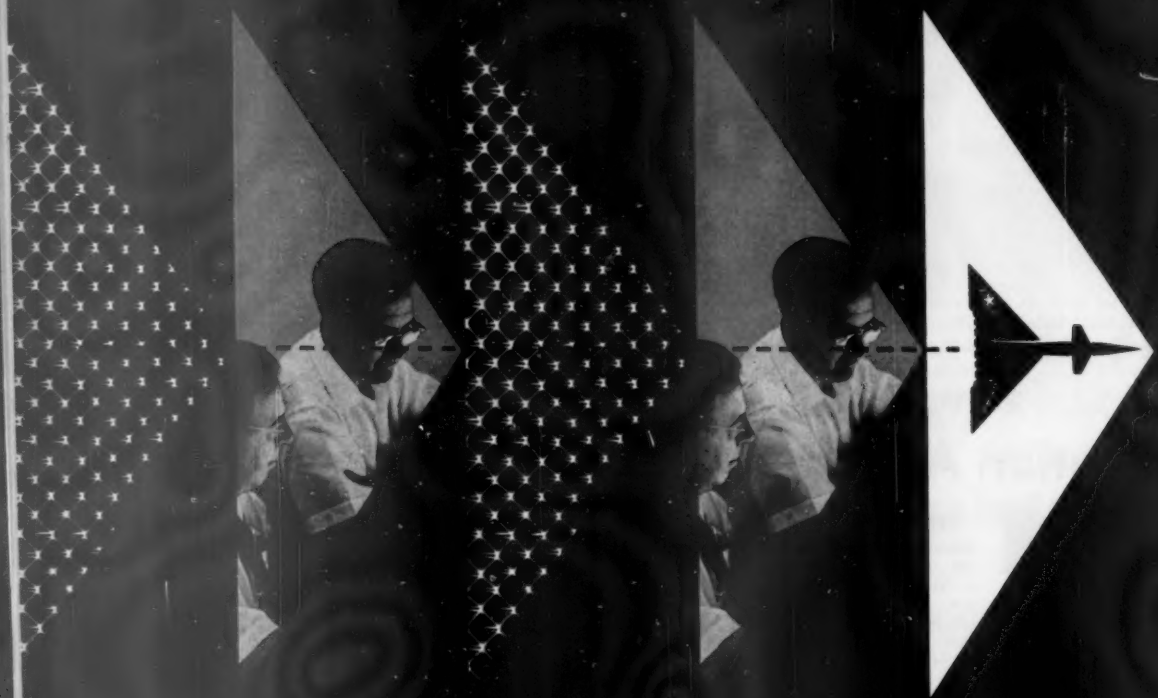


"Stutz Bear Cat" letter holder



The "Stutz Bear Cat" letter holder has nine wire parts (see diagram). After forming them, solder A to the back of B, C to the front of B, and D to the front of C. The forward uprights of the letter rack (F) back up the whole car assembly and are given rigidity at the bottom by the base units (G). Apply the wheels (E) last.

Again, fixed dimensions are not important, but C should be about 8-in. long and the overall height of the letter holder should be about 3½ in.



In-motion x-ray inspection on Du Pont "Cronar"* film fractions costs and time

North American Aviation, Inc., uses an x-ray tube coned down to a narrow slit to make exposures on honeycomb panels manufactured for the Air Force's 2000 m.p.h. B-70 bomber. Foreman Wally S. Demming and Production Development Lab Associate Glen E. Boyce, seen above, are inspecting one of the pictures. They are made with a constant KVP and MA as the panels travel across the tube, moving 1-5 feet a minute.

Panels are angled so that the nodes (where core cells join) are not superimposed in the picture. Motion blurs out the brazing fillet on the tube side of the panels, allowing a larger area to be radiographed. CRONAR 506 or 510 film is used in specially-designed plastic holders that are a foot wide and from 2 to 10 feet long.

The unique clarity of CRONAR films—plus the consistency of their emulsion and the stability of their base – adds to the accuracy and economy of North America's in-motion technique. To learn more about these films and other fine industrial x-ray products, write E. I. du Pont de Nemours & Co. (Inc.), Photo Products Department, Wilmington 98, Delaware. In Canada: Du Pont of Canada, Ltd., Toronto.

*Du Pont registered trademark for its polyester photographic film base

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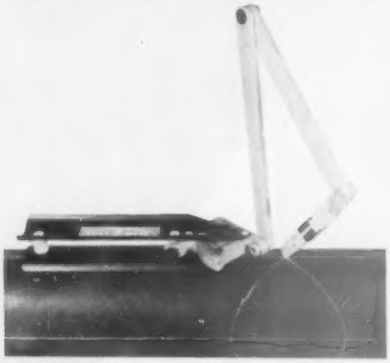
Better Things for Better Living
. . through Chemistry

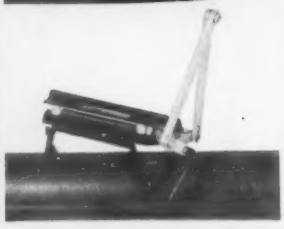
CURV-O-MARK

Contour Markers



Marks off any pipe joint or structural angle cut accurately, easily and without figuring cutbacks. Contour Markers mark all around pipe — save both time and gas. Available in 2 sizes of 1½" to 18" in cross-section, 16" to 48" diameter.

Combination Adaptors



FOR CONTOUR MARKER

Adaptor allows layman to use all sides of Contour Marker in layouts on pipe and structural steel. Standard model marks up to 30" pipe, without having to quarter or halve. Marks over surface irregularities and old welds, and without having to break wrap so far back on wrapped pipe. Compound angles can be marked in one setting of tool; also, any portion of tube turns or 90°. The combination adaptor also furnished for the Jumbo Marker on special order.

Pro-Mag-Level

Pocket size and equipped with two magnets on each plane for holding level in position. One side is machined flat for flat work, and the other, to a slight V-plane for pipe. Besides level, Pro-Mag-Level is equipped with 90° dial marked in 2½° increments and scales for rise in degree per foot or meter. Frame made of strong cast aluminum.

CONTOUR SALES CORPORATION

1843 E. Compton Boulevard Compton, California

For more facts Circle No. 178 on Reader Service Card

ALL-welded aluminum excursion vessel (above) will carry 89 passengers. Hull (right) was formed upside down for Mig welding, then righted.

All-welded excursion boat to ply the Pacific waters

AN ALL-WELDED ALUMINUM excursion vessel will soon be plying the waters between southern California points and Santa Catalina Island, 22 miles off the coast.

Built by Chaffee Machine Co., San Diego, the 65-ft.-long, 18½-ft. wide *Cabrillo* was fabricated from 5086 aluminum sheet and plate supplied by Kaiser Aluminum & Chemical Corp.

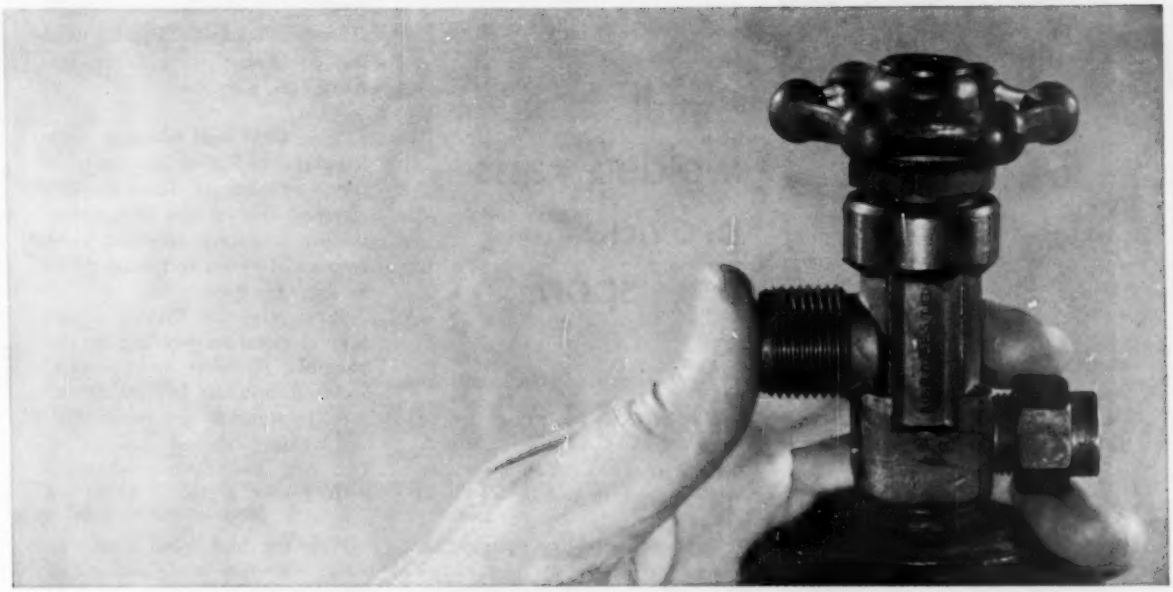
The hull was formed upside down to facilitate shell plate welding in the flat position. When the hull section was completed, it was righted and blocked in position for cabin and superstructure work.

The more than 30,000 lb of aluminum alloy was Mig welded, using 100% argon as the arc shield. Welding units with CAV power sources were manufactured by Air Reduction Sales Co., New York City, while all filler wire was supplied by All-State Welding Alloys Co., Inc., White Plains, N. Y.

Internal framing was angle-sawed to fit flush with the contour of the shell plating. Thus, welding voids between the framing and hull surface were eliminated, giving the hull a distinct strength advantage.

The entire construction and design of the vessel was closely supervised by the Coast Guard and all welding met X-ray quality standards.

The *Cabrillo*, believed to be the first ocean-going craft of its kind, has a capacity of 89 passengers and a cruising speed of 21 knots.



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When you think of the work an oxygen regulator must perform every working hour, it pays to select the one that affords the greatest safety to life and property. It must work with maximum reliability, pressure reduction accuracy and with the minimum of repair. A regulator out of service requires a replacement or creates a job delay. Stop and think it over . . . the selection of a good regulator gives freedom from repair, performance accuracy and operator satisfaction.

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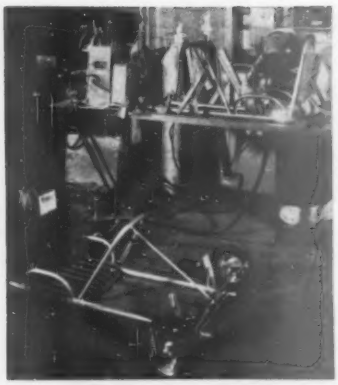


WITH finished kart in foreground, welder is producing another frame in a specially-designed jig.

Small welded karts provide new sport

CO_2-Mig welding cuts cost of producing the steel tube vehicles.

WELDED SPORT KARTS — ranging from driveway models for kids to highspeed racers for adult enthusiasts — are springing up all across the country.

The small sled-like vehicles, on which the driver sits just inches above the ground, can be constructed to reach speeds greater than 60 mph.

Mercury Tool and Machine Service, Waco, TEX., manufactures a full line of these karts using a 0.062-in.-thick tubular steel frame, jig-assembled with CO_2-Mig welding equipment from Linde Co., New York City.

Type 1020 steel tubing is cut to length, coped and bent to form frame components. These are then clamped in a jig and fillet-welded using a Mig torch operating at 90 amp and 18 volts and using 0.030-in.-diameter wire.

Previously, the firm had used manual metal-arc welding on this assembly. However, weld porosity occurred, resulting in poor appearance. In addition, slag removal after welding slowed production. Two men were able to produce only 10 frames a day at $7.50 per unit.

With the high-speed semiautomatic operation and spatter-free welds of CO_2-Mig welding, weld appearance has improved, and no post-weld finishing is required. In duce 20 frames a day at only $4 addition, two men can now proper unit.

Riegel

...the preferred glove among skilled welders

TOPS IN DOLLAR VALUE

CHOSEN BY SKILLED WELDERS for extra heat protection, greater finger dexterity, and all-around comfort. Horsehide and "Flextan" leathers stay soft after dry-cleaning. Exposed seams completely welted. Seamless backs.

CHOSEN BY EXPERIENCED BUYERS for soft, sure comfort, longer wearability, excellent price, and quick acceptance in the plant...backed by Riegel's ready service and quick delivery.

COMPLETE LINE for any welding need. Let Riegel's specialists help match the right glove to the job. Ask for free catalog.

GENUINE HORSEHIDE PALM No. 956
Horsehide Palm, clute pattern cut extra long to prevent wrist chafing, and fourchetted for extra comfort and dexterity. Welted and wool-lined for complete protection.

HEAVY WELDER No. 997
Top quality green "Flextan", lined for heavy, hot jobs.

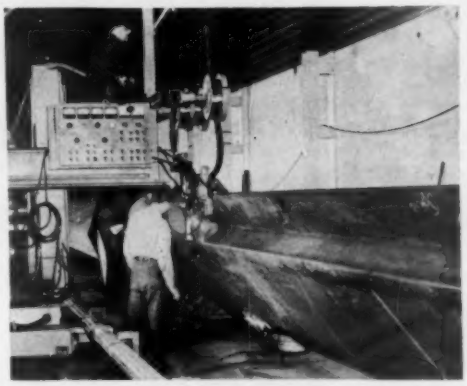
WELDERS MITTEN No. 987
Green "Flextan" leather, excellent protection, flexibility of finger movement.

SPOT WELDER No. 897
For lighter jobs, unlined green "Flextan" leather.

RIEGEL TEXTILE CORPORATION • Conover, N. C.

IN SUMMARY . . .

Canada's first detinning plant, a $1 million facility, is being built by **Metal & Thermit Corp.**, New York City . . . Business formerly conducted by the **Kidde Precision Tool Corp.**, Roseland, N.J., has been sold to the newly-formed **KPT Mfg. Co. . . . International Resistance Co.**, Philadelphia, has entered the semiconductor field with the purchase of controlling interest in **North American Electronics, Inc.**, Lynn, Mass. . . .



The nation's first bridge to be fabricated with the use of numerically controlled machining is now under construction at **The R. C. Mahon Co. Structural Steel Division,** Detroit. Automatic tandem submerged arc welding (see cut) is reducing welding time on the bridge's structural steel components by as much as 80% . . .

North American Aviation Inc. has licensed **Seaporcel Metals, Inc.**, to use a newly developed coating, Cermet 16, and a related coating process for protecting metals subject to extraordinary temperature extremes . . . **United Sheet Metal Co., Inc.**, Columbus, Ohio, has purchased the Biggs Boiler Works, Akron. . . .

The **Philadelphia Industrial Development Corp.** will build a $2½ million research building for **The Franklin Institute** on a site adjacent to the Institute's main building . . . **All-State Welding Alloys Co., Inc.**, White Plains N.Y., has made its aluminum welding and brazing alloys 718, 1100 and 4043 available with "Nuclear Grade" certification.

A condensed catalog of high vacuum components and equipment made by **NRC Equipment Corp.**, Newton, Mass., is available to individuals who request it by writing on company letterhead to the firm at 160 Charlemont St., Newton 61, Mass., or to local distributors . . .

The **American Zinc Institute** and the **American Hot Dip Galvanizers Association,** Washington, D. C., have voted to launch a joint research and development campaign to expand the uses of hot dip galvanizing and have earmarked a substantial sum for the initial effort . . . **Stupp Bros. Bridge & Iron Co.**, St. Louis, has completed a 40,000-sq-ft weldment department addition . . .

A new sign (see cut) recently flashed into view on Cleveland's east shore way to advertise **Burdett Oxygen Co.**, Cleveland. The 90-ft. long and 40-ft. high sign contains about 1,800 ft of neon tubing which animate the figure of a workman cutting steel – complete with make-believe sparks . . .

A four-lecture series on welded structural design, including plastic design, will be sponsored by the Pittsburgh section of AWS on March 7, 8, 14 and 15 at the Bureau of Mines auditorium on Forbes St. . . . **Boeing Airplane Co.**, Seattle, has signed a contract for volume delivery of magnesium tooling plate from **Dow Metal Products Co.**, Midland, Mich. Welding fixtures are among the tooling fixtures involved . . .

VIPs in review . . .

In a realignment of top level administrative posts at Alloy Rods Co., York, Pa., *M. G. Sedam* has been elected president of the firm and *Edward J. Brady* has become chairman of the board of directors. Brady, who founded the firm, will continue as chief executive.

International Harvester Co., Chicago, has appointed *Charles D. Evans* manager of manufacturing research. He succeeds *W. D. Bryson* who has been elected vice president of Solar Aircraft Co., an International Harvester subsidiary.

Ralph F. Gow was elected president of Norton Co., Worcester, Mass., at a recent company meeting. *Milton P. Higgins*, president since 1946, became chairman of the board succeeding *George N. Jeppson* who remains on the board as honorary chairman. *John Jeppson* has been named executive vice president and *Robert Cushman* and *Richard M. Nichols* have been named directors of the company.

Richard J. Conners, Jr., has been appointed regional manager for the central region for Insto-Gas Corp., Detroit. Conners will cover Ohio, Kentucky, Indiana, West Virginia, and western Pennsylvania.

Harold W. Bigelow has been appointed midwest district sales manager for the Semiconductor Division of Syntron Co., Homer City, Pa. Bigelow will make his headquarters in Chicago.

M. W. Townsend has been elected to the newly-created position of executive vice president of Handy & Harman, New York City. Townsend is also responsible for the sales department.

Townsend

Fisher

William J. Fisher has been appointed sales manager of The Berkley-Davis Co., Danville, Ill., a subsidiary of The McKay Machine Co., Youngstown, Ohio.

Kenco Welding Supplies, Cupertino, Cal., has employed *Wesley F. Fisk, Jr.*, as regional sales representative in northern California, southern Oregon, and western Nevada.

Fisk

McIlvain

Manager of the new San Antonio furnace processing plant of Wall Colmonoy Corp., Detroit, is *L. E. McIlvain*. McIlvain has been chief metallurgist at Kelly Air Force Base for 7½ years.

H. Y. Martindill has been appointed general manager of United Specialties Inc., El Dorado, Ark. Martindill has been with United Specialties for 7 years as plant manager and design engineer.

David S. Soliday, Jr., has been named marketing manager of the warehouse division of Chase Brass & Copper Co., Inc., Waterbury, Conn. Chase has also appointed *Henry L. Burghoff* director of research and development.

At Arcos Corp., Philadelphia, *Michael M. Clarke* has joined the Chicago district office and *John K. Light* has been named assistant to the executive vice president.

Donald E. Shryock has been appointed field representative for the Arcair Co., Lancaster, Ohio. He will work in the midwestern United States with distributors and a broad range of industries.

The Arc Welding Section of the National Electrical Mfg. Association has elected *L. D. T. Berg* chairman. Berg, manager of the equipment marketing department of Air Reduction Sales Co., New York City, succeeds *Robert T. Brown*, general manager of the welding products division of Metal & Thermit Corp., New York City. *Marvin G. Sedam*, president of Alloy Rods Co., York, Pa., suceeeded Berg as vice chairman of the section.

Skil Corp., Chicago, has promoted *Harry L. Bullock* to general sales manager and *Carl G. Butman* to marketing services manager.

Charles R. Eddy has been appointed eastern factory sales representative for Sellstrom Mfg. Co., Palatine, Ill. He will cover the east coast territory from Maine to Virginia.

Ludwig Mies van der Rohe has been awarded the J. Lloyd Kimbrough Medal by the American Institute of Steel Construction, Inc., New York City. The award was presented to the founder of the "Miesian" school of architecture on his 75th birthday.

Charles W. Lytton, district manager for The Lincoln Electric Co., Cleveland, has been named "District Manager of the Year" by the firm. Lytton was cited for his management of the Pittsburgh district which produced a 19% increase over 1959.

Lytton

Gencur

Andrew F. (Jimmy) Gencur has been named assistant sales manager of the finished products division of the Detroit Stamping Co., Detroit. Gencur joined De-Sta-Co in 1928.

The Grinding Wheel Institute has named the following committee chairmen for 1961: *H. D. Leitten* of Electro Refractories & Abrasives Corp., Buffalo, chairman of the packaging committee; *D. S. Saurman*, Simmonds Abrasive Co., Philadelphia, chairman of the public relations committee; *W. L. Kenagy*, Simmonds Abrasive Co., chairman of the research projects committee; *F. C. Stockinger*, Bay State Abrasive Products Co., Westboro, Mass., chairman of the safety committee; *H. J. Jeffers*, Bonded Abrasives Div., The Carborundum Co., Niagara Falls, chairman of the standardization committee; and *H. D. MacMaster*, Keystone Abrasive Wheel Co., Carnegie, Pa., chairman of the technical committee.

Reprints from WE

Reprints of certain articles published in Welding Engineer are still available. A list of these appears below. Reprints may be obtained for 15 cents each, except where otherwise noted. Payment must accompany all orders. For quantity orders, write for special prices. Order by title from: Reprint Editor, Welding Engineer Publications, Inc., Box 28, Morton Grove, Ill.

Fundamentals of wear resistant overlay
Explains causes of metal deterioration and how to avoid it and how to select a welding process for hardfacing. This reprint 25¢ each.

Techniques for torch brazing aluminum
Procedures and techniques for brazing aluminum, are detailed. Includes data sheet on brazability of aluminun alloys plus four tables listing commercial products and their characteristics. This reprint is free.

Design for welding
Basic knowledge required when designing, or redesigning for welded construction is detailed and discussed. Sixteen page reprint includes 11 data sheets.

The meaning of weldability
Weldability of carbon steels and alloy steels, as well as some other metals, is discussed. Sixteen page reprint includes three data sheets.

How to weld T-1 steel
Explains how to weld this high-strength low-alloy metal. Includes a data sheet on T-1 mechanical properties.

Fundamentals of oxyacetylene welding
Gives the basic essentials on and primary steps of oxyacetylene welding.

Welding of dissimilar metals
Complete details on welding dissimilar metals using NiCrFe electrodes and wires. Eight page reprint includes charts on properties, test results and data sheet on properties of other metals.

Acetylene
A 12 page salute to the IAA and acetylene, details the great success of this gas. Includes a history of the IAA and "The Acetylene Journal."

Fixtures for brazing
Presents requirements for designing brazing fixtures and materials to be used. Data sheet on properties of non-metallic fixture materials included. Free.

Filler metals for joining
Brazing filler metals are detailed and each group is analyzed. Includes data sheet on how to select silver brazing alloys.

Production welding controls
Discusses how material, labor and overhead effect total production welding costs, and how certain controls can result in greater time and dollar savings. This reprint is free.

New aluminum alloy not prone to brittle fracture
Extensive testing of 5083 aluminum alloy proves it has excellent weldability and weld ductility, and a good resistance to corrosion and stress corrosion. Testing for brittleness is detailed. This reprint free.

Explosive welding and forming open another door
A report on one of the newest entries into the welding industry, and how one pioneer company turned theories and practices into realities.

Our modern-day mythology
A rebuttal to some old-wives tales about the hazards of welding fumes, plus safety recommendations for situations where hazards might develop.

Understanding weld distortion and shrinkage
Causes of distortion and shrinkage can be determined if weld heat is understood. Eleven drawings are used to illustrate this welding problem.

NEW Complete... Welding Facilities

FOR TOUGH WELDING PROBLEMS

Rosemount Engineering Company announces the installation of a 36" chamber Electron Beam Welder in its Welding Department. REC's certified welding facilities include:

- Electron Beam Welding—from .003" foil to .500" plate —including exotic metals such as beryllium, molybdenum, tungsten and zirconium
- Tungsten Inert Gas Welding
- Metal Inert Gas Welding
- Aircomatic Gun—permits rapid deposits of wire for distortion control
- Stake Seamer—for controlled arc penetration and accurate positioning of parts

WELDING SERVICE AVAILABLE—REC's welding engineers provide consultation and establish welding procedures for difficult problems on an R and D basis. REC's welding facilities are available for production work on an hourly or piece basis. Write, wire or call if we can be of service on jobs requiring broad R and D or production experience.

REC

ROSEMOUNT ENGINEERING COMPANY

4900 West 78th Street • Minneapolis 24, Minnesota

For more facts Circle No. 181 on Reader Service Card

Tempilstik°

*temperature indicating crayons**

*Also Tempil° Pellets and Tempilaq° (liquid form)

Tempilstik°—a simple and accurate means of determining preheating and stress relieving temperatures in welding operations. Widely used in all heat treating—as well as in hundreds of other heat-dependent processes in industry. Available in 80 different temperature ratings from 113°F to 2500°F . . . $2.00 each.

Send for free sample Tempil° Pellets. State temperature desired . . . Sorry, no sample Tempilstiks°

Most industrial and welding supply houses carry Tempilstiks° . . . if yours does not, write for information to:

WELDING SALES DIVISION

Tempil° CORPORATION
132 West 22nd St., New York 11, N. Y.

Visit Us at Booth 528 — A.W.S. Welding Show
New York Coliseum — April 17 - 21
Circle No. 182 on Reader Service Card

Rankin Mfg. Co., Alhambra, Cal., has appointed *Eugene M. Rutt* to the position of general sales manager. Rutt has represented Rankin in the northwestern states and western Canada.

Rutt

Moody

In changes at Air Reduction Sales Co., New York City, *N. F. Moody* has been named regional sales manager of the eastern region; *R. H. Merriman* has been appointed district manager of the Philadelphia office; *J. W. Cunningham* has been named manager of the Pittsburgh district sales office; *H. D. Mann* has been appointed assistant manager of engineering services in the Cleveland district office; and *C. M. Pettys* has been appointed assistant manager of distributor sales for the Louisville district.

Crucible Steel Co. of America, Pittsburgh, has appointed *J. W. Slattery* to the new post of manager of distributor relations and *W. B. Downes* to the newly-created post for handling executive customer relations. Crucible has also appointed *D. W. Kaufman* product manager of stainless steels.

At a recent board meeting, Raybestos-Manhattan, Inc., Passaic, N. J. appointed *S. R. Zimmerman, Jr.*, executive vice president of the firm. The company has also appointed *R. B. Park* as sales manager of industrial rubber and mechanical packings.

J. S. Alsburg has been assigned to Chicago Bridge & Iron Co.'s international sales office in New York. Alsburg is a 1952 graduate of Michigan State University with a degree in civil engineering.

David J. Champion has been appointed vice president of The Champion Rivet Co., Cleveland. Formerly sales manager of the firm, he is the son of *T. Pierre Champion*, company president. Champion Rivet has also named *Joseph A. Diemer* to be assistant to the president. Diemer joined the firm as purchasing agent in 1947.

Three top level changes were voted at a recent board of directors meeting of The Bastian-Blessing Co., Chicago. *Lewis G. Blessing*, president since 1931, was elected chairman of the board. *Allison L. Augur* was elevated from executive vice president to president, and *Lawrence N. Lucas* replaced Augur as executive vice president.

At right is *G. R. Milne*, president of the newly formed Air Reduction Chemical and Carbide Co. His picture was published in last month's issue next to a personnel item about another man with the same last name.

Milne

Died . . .

Pierre Balteau, 40, president of the Usines Balteau Co., Liege, Belgium died Feb. 15, 1961 in an airliner crash near Brussels. Mr. Balteau, a Belgian, had organized the Balteau Electric Co., Stamford, Conn., and was also president of the Electrotecnica Balteau, Mexico City, Mexico. He is survived by his widow and two children.

Balteau

William Dana Hooper, 49, assistant manager of the statistical department of Linde Co., New York City, died January 6, 1961 in New Canaan, Conn. He is survived by his widow and three daughters.

James E. Candlin, Jr., 53, associate director of research and development for Pullman-Standard, Chicago, and a foremost designer of railroad passenger and freight car equipment, died at his home in Lansing, Ill., on Feb. 3, 1961. He is survived by his widow, two daughters and a son.

William Finneran, Chicago district sales manager of A. O. Smith's welding products division, died recently at his home.

Eduard J. W. Egger, 63, regional engineer for Linde Co., New York City, died January 22, 1961 at his home in Bellevue, Pa. He is survived by his widow, one son, a daughter and five grandchildren.

New products . . . . . use card on page 81

Steel-welding process

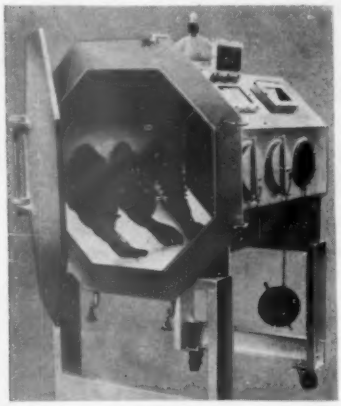
Process uses CO_2 shield and low-alloy steel wire on mild steel. No special equipment required. Advantages include spatter-free welding, open arc, spray-type transfer, good weld appearance, sound welds, economical deposition rates, continuous wire feed and low-cost shielding gas. Special wire for process has ultimate tensile strength of 70,000 psi and yield strength of 60,000 psi. Wire available in 0.045 and 0.054-in. diameters. *Air Reduction Sales Co.*

Circle No. 1

Thermocouples

Heat treating thermocouples are made with matched and graded 14-gage wire and are processed and tested for accuracy to 1,900 F. Positive junction with work is provided by stainless steel tips enclosing thermocouple heads. *Electric Arc, Inc.*

Circle No. 2



Inert-gas room

Vacuum dry box is portable inert-gas room for inert atmosphere welding. Box can be exacuated to 50 microns with leak rate of 1 micron per minute. Several people can work simultaneously. Unit is equipped with low-permeability Butyl gloves and evacuable glove ports, air-lock, fluorescent lamp, welding windows. *Controlled Atmosphere Enclosures Mfg. Co.*

Circle No. 3

A-c welder

"S" series a-c 300 and 500-amp industrial welders forgo frills to attain lower price, states manufacturer. Features include movable coil design, 80-volt open circuit, superior cooling, silicon steel cores, Class B insulated copper coils, dead front construction and lifetime enamel finish on heavy-gage steel case. *Miller Electric Mfg. Co.*

Circle No. 4

Sealing compound

Permanently flexible, waterproof sealing compound can hold two 1-in. wooden blocks so a 1,500-lb pull is required to separate them. Quick-setting, white, non-yellowing, it is permanent and non-cracking. Non-tacky compound can be smoothed out or shaped by wetting. Excess can be removed with damp cloth. *Devcon Corp.*

Circle No. 5

Helmets, handshields

Oxweld line includes 6 welding helmets, 2 handshields. Three shell-type helmets with straight, curved and narrow front are available with stationary or lift-front glassholders. Handshields are available in straight or curved-shell models. All shells molded in one seamless piece from glass fiber reinforced polyester which is lightweight, strong and resistant to sparks, molten metal and flying particles. *Linde Co.*

Circle No. 6

Metal-cutting saw

"Super saw" makes straight, curved and circular cuts in practically any material including metal plate, angle iron pipe, conduits and plastic laminates. Blade is set at offset angle for faster cutting and longer blade life. Features include vibrator-free reciprocating mechanism driven by ½-hp motor, lightweight aluminum housing, locking trigger switch and 15 interchangeable blades. *Millers Falls Co.*

Circle No. 7

Laboratory furnaces

Laboratory furnaces are custom-built and platinum wound. High-temperature units for high-temperature calibrations can be used at temperatures up to 1,800 C with any shape and wall thickness of ceramic muffle up to 5-in. or more inside diameter and heat zone lengths up to 4 ft. *Engelhard Industries, Inc.*

Circle No. 8

Dust respirator

All-plastic dust respirator has permanent, washable foam filter element. Other features are: light weight; 3-piece design; one-size fit for all faces. Outer frame is light gray with pliable polyethylene cushion. Inner frame locks filter easily into place for perfect seal. Nontoxic, non-allergic. *Glendale Optical Co., Inc.*

Circle No. 9

Pipe thawer

Small transformer makes it possible to thaw frozen pipes by using ordinary a-c circuits, 110 or 220 volts, single phase 50 or 60 cycles. Unit, complete with 10-ft power cable with plug and receptacle and two 20-ft thawing cables with lugs and pipe clamps, can be carried by one man. Case is 16⅝ in. by 11⅛ in. by 10⅝ in., weighs 63 lb. Transformer rated at 300 amp, 10 volts on 100% duty cycle. Electrical connection elimination between power line and output terminals makes it safe to operate. *Hobart Bros. Co.*

Circle No. 10

Electric cable

Large-capacity multi-conductor electric cable can be safely bent and looped with flexibility of rope. Application includes use as induction coil in stress relieving with induction heating. Made with multiple nickel-plated conductors encased in woven nipalte copper sleeves, cable comes in sizes from 210,000 to 500,000 circular mills with capacities from 25 to 1,000 amp. *Electric Arc., Inc.*

Circle No. 11

Core solder

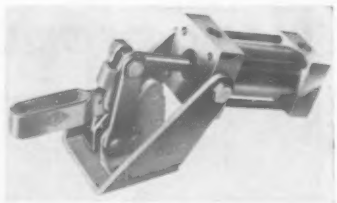
Hydrazine activated core solder can be used in soldering all electrical and electronic equipment. Solder leaves no resin residue, is non-corrosive and non-hygroscopic. It vaporizes completely at soldering temperatures, eliminating cleaning and costly residue removal. Flux can be used to soft-solder copper, brass, hot tin dipped, hot solder dipped, tin plate, solder plate, copper plate, cadmium plate, zinc, silver plate, beryllium copper and nickel plated brass. *Fairmount Chemical Co.*

Circle No. 12

Safety hats

Safety hat features suspension assembly requiring only sweatband, sizing band and supporting crown. Lightweight hat fits head sizes 6⅝ to 8, features 3-position adjustment. Snap-type fittings easily changed without tools. Chin straps optional. Hats come in 8 colors. *Boyer-Campbell Co.*

Circle No. 13



Toggle clamps

Air or hydraulic-operated toggle clamps are designed for hard-to-reach areas and rapid sequence of assembly operation on light jobs. Over-center toggle locks eliminate bounce or recoil. Work rated with holding pressures to 450 lb at 80-lb line pressure. Model 807-L has solid bar with spindle retainer. Model 807-U has standard "U" bar. Model 807-UL has long "U" bar. Cylinders provide operating pressures to 150 psi for air and 250 psi for oil. *The Detroit Stamping Co.*

Circle No. 14

Nuclear gages

Nuclear gages permit use of either beta or gamma radiation, extending application range from thinnest tissue paper to thick steel. Gamma sources with high penetrating power allow measurement to within ±0.001-in. steel. Beta sources allow thin sheets and foils to be measured within a few microinches. High response speed, down to 10 milliseconds, permits high-speed inspection. *Radionics, Inc.*

Circle No. 15

PROGRESSIVE makes BIG fixtures
For many years Progressive has pointed the way to better production in American Industry with new ideas in welding equipment and fixtures.
Today Progressive's modern facilities and extensive experience offer dependable solutions to the many unusual problems confronting industry the world over.
This gigantic (24′ diameter x 70′ length) booster assembly fixture for the Saturn missile, shown above, is a good example of Progressive's tremendous facilities and abilities.
Progressive's experience can save you time and money. Our engineers will gladly discuss your requirements.
THE PROGRESSIVE WELDER & MACHINE CO. 915 Oakland, Pontiac, Mich.

Air compressors

Air compressor 150-3 (lower right) is fully automatic heavy-duty portable unit with 10½-gal tank, variable pressure capacity to 135 lb and ½-hp electric motor, capacitor with high starting torque. Model 150-2 (center) is heavy-duty fully-automatic twin-air compressor with detachable compressor and portable tank. Available with 135-lb pressure capacity or ASME tank. Model 151-4 (top right) as above but can be purchased with 2-hp gasoline engine or ½ or ½-hp electric motor. *Twentieth Century Mfg. Co.*

Circle No. 16

Welding screens

Carrying handles which double as loops for hanging have been added to firm's welding screens. Screens can be rolled and transported on welding cart or by hand. With UL approved covers in Duck or Weld-Tex vinyl coated glass cloth, screens come in 7 standard sizes ranging from 18 in. by 36 in. to 72 in. by 108 in. *Frommelt Industries, Inc.*

Circle No. 17

Abrasive wheels

Resinoid depressed center disc grinding wheels are triple reinforced. Wheels are available in 7 and 9-in. diameters. Thicknesses are 1/8 in., 3/16 in., 1/4 in. and 3/8 in. Wheels have 7/8-in. depressed center hole and are made in complete range of grain sizes from 14 to 120. *Atlantic Abrasive Corp.*

Circle No. 18

Power units

Double pump power units have 1,000 and 2,000-psi capacities. DCP unit offered in standard 30 and 60-gal reservoir sizes with combined pump capacities to 33 gpm. All units have 1,800-rpm motor. By using double pumps in conjunction with unloading valve panel, hp requirements are reduced, oil temperatures lowered and maximum circuit efficiency is realized. *Hannifin Co.*

Circle No. 19

TUFFALOY forged seam welder wheels provide the utmost in conductivity and long life. Photo by Taylor-Winfield Corporation.

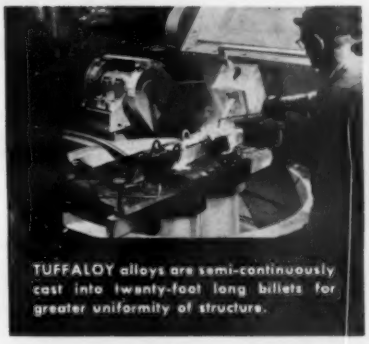
TUFFALOY FORGINGS

Fault-Free and Right on Spec

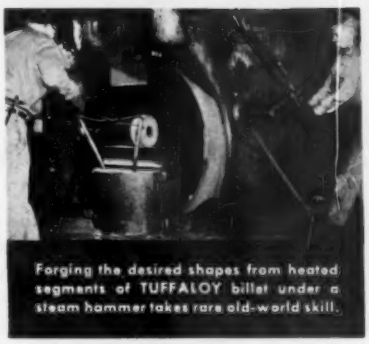
To carry the current they should and withstand the pressure they must, resistance welding alloy parts have to be right on specification both as to composition and structure.

RWMA specification forgings by TUFFALOY are used for seam welder wheels and shafts, butt and flash welder dies, and welding platens. TUFFALOY's more than twenty-five years in producing these forgings have led to the establishment of the largest stock of forged bars and wheels anywhere.

For fault-free forgings—wheels (finished or unfinished), square or rectangular bars, and special shapes of all kinds, all heat-treated or cold-worked to maximum hardness, specify TUFFALOY.



TUFFALOY alloys are semi-continuously cast into twenty-foot long billets for greater uniformity of structure.



Forging the desired shapes from heated segments of TUFFALOY billet under a steam hammer takes rare old-world skill.

Doc Tuffy says . . . to make sure every TUFFALOY forging meets hardness requirements, every forging is tested individually. TUFFALOY people will always go a step further to maintain product superiority.

Write or call your nearest AIRCO or TUFFALOY distributor. Ask whether your forging needs are now in stock. Ask him too for the TUFFALOY catalog . . . it makes correct alloy and tip specifications easy.

THE TRADEMARKS TO TRUST
AIRCO®

AIRCO®

AIR REDUCTION SALES COMPANY

A division of Air Reduction Company, Incorporated

150 East 42nd Street, New York 17, N. Y.

More than 700 Authorized Airco Distributors Coast to Coast

On the west coast: Air Reduction Pacific Company, **Internationally:** Airco Company International, **In Canada:** Air Reduction Canada Limited

ALL ARE DIVISIONS OR SUBSIDIARIES OF AIR REDUCTION COMPANY, INC.

"Four Nines"

make $99.99 equal $134.94!

That's right—buy the whole package and you save $34.95! This is a complete "Purox" welding and cutting outfit that you can amortize in just a few jobs.

Sold separately, these components would list at a total price of $134.94—still a good buy, considering the top quality that "Purox" stands for. But with this "Four Nines" kit, you get a complete outfit for welding, cutting, heating, and brazing . . . all first-quality materials at a budget price. The "Four Nines" Outfit includes a welding torch with three heads, cutting attachment with one nozzle, oxygen and acetylene regulators, 12½ feet each of oxygen and acetylene hose with fittings, friction lighter, and goggles.

See it at your LINDE distributor's. Or, write for literature to Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada,* Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

LINDE COMPANY

UNION CARBIDE

"Linde," "Purox," and "Union Carbide" are registered trade marks of Union Carbide Corporation

Infrared heaters

Electric infrared heaters for direct radiant heating of welding areas concentrate heat without heating surrounding areas. Unit can be easily added to existing buildings without disturbing walls, floors or requiring expensive modification of existing heating plant. Effect of radiant heating is immediately felt as soon as heater is turned on. UL approved units are available with low-brightness quartz tubes or high-efficiency quartz tubes. *Fostoria Corp.*

Circle No. 20

Voltage compensators

Heavy-duty line voltage compensators can reduce ±10% line voltage fluctuations to ±1%. Available for all single or three-phase line voltages to 600 vac, the compensators are self-contained convection-cooled units with 100% duty cycle ratings to 400 kva output per unit. Voltage regulation time response is adjustable and electronic sensing circuitry is available. *Glenn Pacific Corp.*

Circle No. 21

Heavy-duty grinders

Heavy-duty grinders and buffers feature 75% increase in power at reduced noise level. Maximum capacity of 74G series is 8-in. organic wheel or 6-in. wire brush at 4,500 rpm. Ratings include 4-in. wheel at 9,000 rpm, 5 in. at 7,200 rpm, and 6 in. at 6,000 rpm with speeds under load maintained by governor. Maximum weight is 10 7/16 lb, and maximum length 19 1/4 in. *Buckeye Tools Corp.*

Circle No. 22

Flexible pigtails

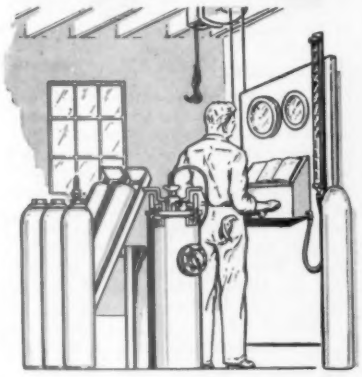
Stainless steel teflon flexible pigtails are designed for cylinder charging under extreme stress through constant connecting and disconnecting. They are suitable for discharging as well. Pigtails are rated at 3,000-psi working pressure. Not subject to work hardening, pigtails have oxygen-compatible teflon liner chemically inert to most high-pressure gases. Integral holding wrench on each pigtail facilitates make-up to cylinder valve. *The Bastian-Blessing Co.*

Circle No. 23

The Test Dates on your cylinders are important too. All cylinders made to ICC specifications must be pressure tested at least once in every 5 years except those that are specifically exempted by ICC.

The method of pressure retesting must insure an accurate measurement of the total and permanent expansion of the cylinder.

The IECO Gas Cylinder Testers are water jacket types, using hydrostatic pressure for accurate, safe pressure retesting, a method that is approved by the Interstate Commerce Commission. These testers are available in standard models to fit your requirements.



install an . . . .

IECO **gas cylinder TESTER** *and*

1. Keep your cylinders on the job. Retest between charges.
2. Keep your truck servicing your customers. No trips to Cylinder Testing Laboratories.
3. Keep retesting cost at a minimum.
4. Keep tester busy — Retest for other users.

SEND YOUR INQUIRIES TODAY TO

INDEPENDENT ENGINEERING CO., INC.

O'FALLON 5, ILLINOIS

Circle No. 186 on Reader Service Card

Shear, end welder

Automatic shear and end welder provides continuous strip for roll forming, tube manufacturing, punch press operation, and coil-strip processing. RD-907 uses mash seam process to join coil strip ends. Complete operation ranges from 15 to 25 seconds. Unit welds continuously from edge to edge of strip. *Guild Metal Joining Equipment Co.*

Circle No. 24

Sample changer

Automatic sample changer handles up to 30 solid radioactive samples and may be used for automatic absorption curve measurements. Changer holds planchet samples to 30-mm diameter and 3-mm or 8-mm high. Two different date-printing systems can be used; a count-and-time printer and a less expensive printing timer. Count-and-time printer records up to 999,999 radioactive counts and up to 999.99 minutes. *Picker X-Ray Corp.*

Circle No. 25

Adhesive

Heat-sealable adhesive for aluminum foil can be applied by spray, roller coater or brush and dries completely transparent. Although almost invisible on aluminum foil, when foil is placed in contact with itself or other surfaces, instant bond is obtained by heat application. Adhesive is packed in 55-gal drums and 5 and 1-gal containers. *Rubba, Inc.*

Circle No. 26

Plasma spray gun

New 25-kw arc-plasma hand spray gun is less than 2-in. long and 1⅝-in. diameter. Weighing less than 1 lb, unit can spray materials on surfaces previously inaccessible. Gun can be used for welding or cutting high melting point materials and carries a 200-hr electrode life guarantee when used with argon. *Plasmadyne Corp.*

Circle No. 27

SPECIALIST-

your

LINDE distributor

It takes more than a line of welding equipment to be a LINDE distributor. It takes real knowledge of your welding needs . . . knowledge of local industry . . . practical experience and interest in efficient welding operations . . .

These are some of the qualifications that make your LINDE distributor so valuable to your business. He's a specialist in his field, equipped with a complete stock of welding and cutting equipment, industrial gases, welding rods, supplies, and accessories. They're all products of highest quality and proved efficiency. Your LINDE distributor is ready to help you today, with equipment, expert advice, and the benefits of LINDE's 50-odd years of welding and cutting leadership.

A telephone call will prove the point. Look up your LINDE distributor in the classified directory. Or write to Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada,* Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

LINDE COMPANY

UNION CARBIDE

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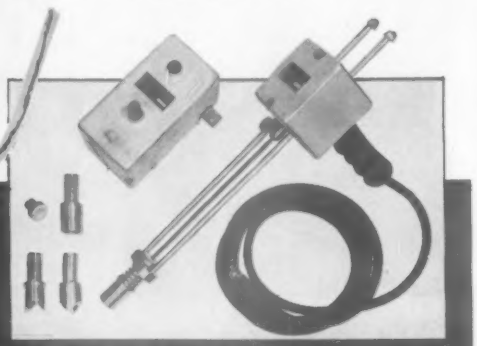
For more facts Circle No. 187 on Reader Service Card

Now

The NO-ARC Electric Welding Gun that uses STANDARD ELECTRODES



NO arc flash . . . no arc shielding
NO gas or water lines
NO special rods

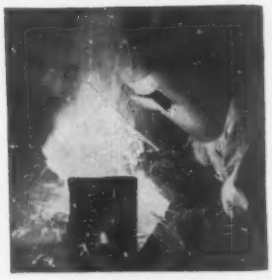
No Other Gun Like it

Here's a shock-proof, fool-proof, labor-saving welding gun for shop or assembly line that spots or welds from one side. For welder or mechanic — **the only gun that bonds stainless or dissimilar metals using stainless steel or conventional steel electrodes.** The NO-ARC gun is easy to use . . . is rugged and dependable . . welds 30-gage or heavy plate without arc flash. Operates on AC or DC.

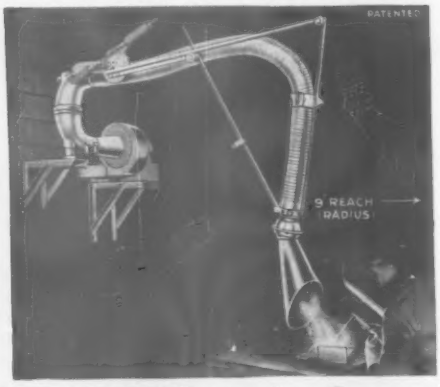
NO-ARC EQUIPMENT COMPANY
321 Academy Street, Newark, New Jersey

Send for free bulletin W-3

RUEMELIN Fume Collectors

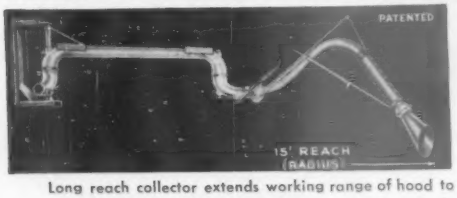


Welding without ventilation. Note smoke and gas clouds.



(Right) Welding with Ruemelin Fume Collector.

REMOVE WELDING FUMES at the Source!



Ruemelin Fume Collectors remove smoke, gas and welding heat. Keep the shop air clean. Efficient and practical. Maximum coverage in welding areas. Your welders work better with this equipment in use. Write for bulletin 37-E describing the new spring-loaded counterbalance mechanism.

Long reach collector extends working range of hood to 15 ft. or 18 ft. operating radius. Double swivel permits hood to work in 360° circle for full coverage.

RUEMELIN MFG. CO.
Manufacturers and Engineers SAND BLAST AND DUST COLLECTING EQUIPMENT
3880 NORTH PALMER STREET • MILWAUKEE 12, WISCONSIN, U. S. A.

Induction heater

Model L6H-P induction heater is suited for heating hard-to-reach areas. It can be used for brazing, soldering and heat-treating applications. Unit features: 2½-kw generator with a-c and d-c overload circuit breakers, timers; 10-ft flexible power cable with water-cooled conductors inside triple-insulated hose; pistol-grip handle; completely enclosed water recirculator; large casters for easy wheeling. *Reeve Electronics, Inc.*

Circle No. 28

D-c welder

D-c welder with continuous voltage and slope adjustment is adapted to high-speed welding on light-gage metal. DRC-33 welder allows operator to make slope and voltage adjustment during welding. Unit provides current as low as 25 amp at 14 volts, can weld alloys and other metals in 0.030-in. range without burn-through or spatter at relatively high speeds. Rated welding current is 300 amp at 100% duty cycle. *National Cylinder Gas Division.*

Circle No. 29

Abrasive disc

Fiber-backed abrasive disc for light grinding operations where little or no dressing action is involved is available in 24 grit to 50 grit range. Clean, chip-free edges obtained when discs cut to smaller diameter. Field testing shows excellent performance on stainless steel grinding, steel panel spotting and repair, non-ferrous alloys and blending operations involving solder or plastic fillers. *The Carborundum Co.*

Circle No. 30

Rod covering

Alginate is used as plastiziser and binding agent in covering material of organic and mineral welding rods. Organic alginate comes in powder form and may be dry mixed with other components before adding water glass. In acid welding rod production, preswelling alginate with water to dough is recommended before adding dry ingredients. *Croda, Inc.*

Circle No. 31

For more facts Circle No. 188 on Reader Service Card

Two-stage regulator

Regulators give two-stage performance with simplicity and economy of single valve, states manufacturer. Output pressures unaffected by varying inlet pressure, and flow capacity unrestricted by extra valving. Regulators will not flutter or vibrate. Gages are unaffected by overpressure. *Kim Products, Inc.*

Circle No. 32

Galvanizing compound

Compound applied to iron and steel structures has withstood 8 years of atmospheric and marine corrosion in all weather. Unlike most paints and coatings, compound contains more than 97% zinc which combines with base metal to set up electrical continuity between zinc particles and base metal. Result is galvanized iron or steel surface without heat. One prime application is the field weld protection on galvanized railings and sidewalk gratings. *Galvicon Corp.*

Circle No. 33

Torch lines

Tubing on water-cooled Tig torch is color coded. Red for power cable; blue for water in; black for gas. Vinyl material meets medium and low temperature class requirements of Mil-I-631, temperature grade A and B. A recommended high-level temperature of 95 C is coupled with a 55 C low temperature. Tubes are fungus resistant, will not corrode bare copper. *Tec Torch Co., Inc.*

Circle No. 34

Metal-cutting saw

Two-speed saw mill will cut all metals including stainless steel. Low speed, 1,000 strokes per minute, for cutting stainless steel, and other hard alloys, cast iron and hard abrasive material. High speed, 1,400 strokes per minute, is recommended for mild steel and nonferrous metals. *Skil Corp.*

Circle No. 35

For more facts Circle No. 189 on Reader Service Card

brazing washers

Edgewound

FROM WIRE STOCK

No die charges
No blanking scrap losses

- No lead time needed for dies or exact strip.
- Use with induction, gas-air, furnace, or other heating methods.
- Available in EASY FLO and SILFOS — Copper, Bronze, and other alloys.
- Diameters up to 4" I.D., wire thicknesses from .010 upward.

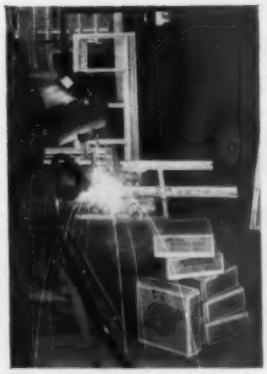
Write for 16 page booklet on better brazing

LUCAS-MILHAUPT *Engineering Co.*

5064 SOUTH LAKE DRIVE, CUDAHY, WISCONSIN

SPOOLED WIRE

USE SPOOLARC®



Rapid fabrication of aluminum window frames by metal inert-gas welding requires trouble free aluminum wire. Philadelphia manufacturer increased his production with mirror-finish All-State SPOOLARC®

for porosity-free welds... constant arc... better control ...fewer errors... faster work

Aluminum wire in all tempers now available in mirror finish, oil-free, precision layer wound spools. ALL-STATE's cleaning and tension controlled winding method produces wire free from helix (twist), permitting welds that do not walk.

Aluminum SPOOLARC® is packaged with desiccant in sealed plastic bags to eliminate moisture, a common cause of porosity in welds.

OTHER METALS—silicon bronze, deoxidized copper, aluminum bronze, phosphor bronze, magnesium, and nickel. Available in SPOOLARC® form. For more information on SPOOLARC® and other ALL-STATE products, send for free 56-page Instruction Manual and SPOOLARC® literature.

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QUALITY WITH SERVICE

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CURTISS WRIGHT

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PORTABLE X-RAY UNITS

Small, portable, high-powered FEDREX units are the most flexible and useful X-Ray equipment ever offered. Their high ma output, long duty cycle and rugged construction are unequalled. Available in 140, 160, 200 and 260 KV units. (160 and 200 KV 360° models also available.) Stepless independent KV and milliampere adjustments over wide ranges permit exact exposure setting without guesswork. Built-in synchronous timer and exposure charts simplify setups and assure accurate results.

Shielding in the X-Ray head reduces stray radiation from all models to 5mr/hr or less at 10 feet. Automatic shut-off controls provide complete overload and flashover protection.

Write for additional information or phone SWinburne 9-0500

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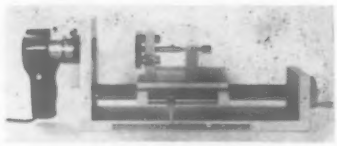


Calibration tester

Plasma-jet-calibration test stand provides method of determining specific enthalpy and total pressure of plasma stream. Test stand is plasma jet mounting stand and variable position platform. Various diameter plasma jet units can be mounted in stand through special inserts. Platform accommodates measuring instruments and material sample holder. Instrumentation available includes heat flux calorimeter and total pressure probe. *Plasmadyne Corp.*

Circle No. 36

Spot welder

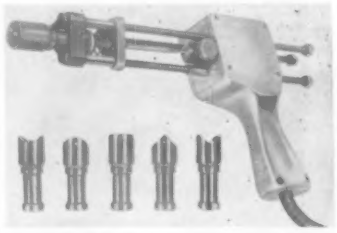
Spot welder is designed for use in both large and small shops where heavy capital investment is impossible. Operating on regular 80-psi line pressure, welder develops clamping force of 1,950 lb and has complete lubricator, strainer, and pressure regulator system. Air valve is integrally mounted with 5-in. double-acting cylinder for maximum efficiency. Transformers are available in 20 to 75-kva range. Aluminum spot welding possible with high-voltage transformer. Work thicknesses from 22 gage to ¼ in. are efficiently handled. *Viking Products Co.*

Circle No. 37

Combustion indicator

Instrument indicates changes in flame characteristics caused by variations in gas fuel supply and air/gas mixture. Continuous-reading device is useful in heating operations where heat transfer rate must be maintained to exacting time-temperature cycles. Unit detects and indicates changes at little as 5 BTU in fuel gas and ±0.5% air in air/gas mixture in 5 seconds. *Selas Corp. of America.*

Circle No. 38



Electric arc gun

Electric arc gun serves as spot welder, stud welder, tack welder, button welder and hole burner. Connected to any a-c or d-c welding machine power supply, unit will burn hole in two or more pieces of metal up to ¾-in. thick with single downward thrust. As hand pressure gradually releases and spring-return mechanism moves gun up, rod melts, filling hole with string weld. Tensil strength of 3/32-in. rod spot weld has been tested at 1,450 lb. *Beeco Mfg. Corp.*

Circle No. 39

Solder-type alloy

Solder-type alloy designed for electrical and electronic work is 50% more electrically-conductive than standard 50-50 lead-tin solder. Highly active flux core is inert after carbonization with non-corrosive non-conductive residues which do not support fungus growth. Alloy's low melting point and high solidification rate prevent hot-shorting and minimize joint movement while plastic. Available in 0.030 and 1/16-in. sizes, 157BN alloy can be applied with soldering iron, torch, hot plate or induction heating. Deposits will accept plating including gold, silver, nickel, platinum, and cadmium. *Eutectic Welding Alloys Corp.*

Circle No. 40

Grouser reconditioner

Reconditioner rebuilds tractor grouser shoes and drive sprockets to factory specifications. Unit combines automatic flame cutting with submerged-arc automatic welding, automatically trims worn sprockets and welds new sprocket rings on hub. Time required to set up, trim, weld and unload is 11 minutes. Unit uses 500-amp a-c power source. *Victor Equipment Co.*

Circle No. 41

High-strength steels

Firm's No. 6 and No. 7 columbium-bearing high-strength low-alloy steels offer minimum yield points of 50,000 and 45,000 psi respectively. No. 6 exhibits welding properties similar to 0.20% carbon steel while No. 7 has properties similar to 0.10% carbon steel. *Armco Steel Corp.*

Circle No. 42

Recorder-controller

Model 30D recorder and controller automatically records and controls protective gas atmosphere dewpoint used in heat treating, brazing and sintering. Sensing unit eliminates condensation and evaporation of water vapor and its extraneous contaminants of the gas sample. Unit eliminates refrigeration. *Barber-Coleman Co.*

Circle No. 43

Multihead welder

Multihead spot welder comes with 4, 8 or 12 heads. Unit features cascade firing to prevent high power demand. Each head has own cylinder and is individually adjustable. Features include timer and switch for each transformer, squeeze and hold timer, and two-stage foot switch. *Alphil Spot Welder Mfg. Corp.*

Circle No. 44

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They mean National Carbide's calcium carbide— Real potent... it's hot-crushed!
All you want— when you want it. In the RED DRUM. Wire for supplier...
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"The Thermo spiral does a better job of working out the carbon and slag without damaging the inside wall. The precision tolerance keeps the tip orifice to true size, giving a straight flame."
Ray Thompson is a recognized expert, repairing thousands of cutting tips each year. He is employed by the Pacific Tip Co. of Los Angeles, Calif.
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Send for a free sample today and find out for yourself why Thermo Tip Cleaners are better.
All progressive welding supply dealers stock Thermo Tip Cleaners.
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NEW SINGER SAFETY SHIELD

In the plant or on the job

★ LIGHTWEIGHT ★ RUST-PROOF
★ LOW COST ★ FIRE-RESISTANT
★ ASSEMBLED OR TAKEN APART IN MINUTES WITHOUT TOOLS

Just think of it—no hooks, no bolts, no screws. Ideal for welding, grinding, machining etc. or can be used straight line as a protecting divider. Rust-proof steel frame with heavy fire-resistant duck curtain—attaches in seconds with with heavy duty snap fasteners.

In 4 standard sizes:
18" x 42", 36" x 48", 36" x 60", 36" x 72"

NEW BIG CATALOG
Describes screens in detail. Complete line of work gloves, welding gloves and safety clothing.

Ask your dealer or write:
Special Products Division
SINGER GLOVE MFG. CO.
860 W. WEED St., CHICAGO 22, ILL.

In 1936, MORT CLARK, then Vice-President of the World's largest sign manufacturer, wanted a welded galvanized sign frame. Every welder manufacturer said it couldn't be done . . . Mort Clark did it, received a check and certificate of achievement from the Lincoln Welding foundation — and

MORT CLARK'S GALV-WELD ALLOY ORIGINAL & GENUINE

WAS BORN

The Navy didn't believe, tested it 3384 hours in salt spray (100 hours is normal), then approved it. Westinghouse reports Galv-Weld roof sign, installed 1936—still perfect in 1959 —23 YEARS LATER!

TIME PROVEN - MODESTLY PRICED
WHY EXPERIMENT?

Regalvanizes corrosive seams and areas where galvanizing is burned away by welding, skipped in hot dip galvanizing, or abraded in fabrication.

Eliminates corrosion areas produced by welding, so that weld will stand up under paint, WITHOUT rust, as on ornamental iron. Simply use residual heat from welding, or reheat, wire brush, and apply. No fluxing—No fumes.

Makes every welder a galvanizer of small weldments or parts. Repairs chipped porcelain, rusted appliances, rusted auto, truck or trailer bodies, frames, fenders, or other steel products. Can be readily refinished to match surrounding surface.

Ideal for pipe joints, galvanized structures, water and fuel tanks, duct systems, cold storage lockers, sinks, drains, washers, towers, steel buildings, railings, etc.

Some distributor franchises still available. Cash in on consistent campaign now running in 18 national magazines.

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Send Information User ☐ Distributor ☐ Dealer ☐ Free Sample ☐
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Circle No. 197 on Reader Service Card

Pipe benders

Portable hydraulic units bend ¾-in. to 8-in. pipe and conduit in one easy operation, cold, without shifting and resetting. Standard shoes available in 64 different radii and sizes with special shoes available. Units have standard or remote control operation, one frame handles rigid and thin-wall conduit, standard 80 and 160 schedule pipe, copper tubing, bus bar and 180-deg radiant-heat coils. *Hein-Werner Corp.*

Circle No. 45

Electronic governor

Electronic governor is for speed control of shunt-wound d-c motors up to 1 hp. Governor maintains constant motor speeds at any selected value despite load variations, line voltage or motor temperature. Operating from 230-volt 50-60 cycle single-phase line, unit available as stripped chassis for incorporation in other cabinet, as rack-mounted unit, or self-contained unit. *Linde Co.*

Circle No. 46

Thin-metal welders

Stored-energy welders are designed for manufacturing high-density packages and welded modules. Equipment includes choice of 6 stored-energy power supplies and 5 weld heads and handpieces. Sizes and ratings are designed to enable selection of setup to meet need for relays, tubes, transducers, pots, thermocouples and high-density component packages. *Hughes Aircraft Co.*

Circle No. 47

Portable nibbler

Portable sheet-metal nibbler develops 2-ton punch-press pressure. No. 691 8-gage unit operates on punch-and-die principle. As nibbler is fed along cutting line, small rectangular metal pieces are punched out leaving smooth edge. Metal on either side of cut is not bent or curled. Unit operates at 1,000 strokes per minute, no-load; 600 strokes per minute rated load. Cuts mild steel to 8 gage on production basis. *Black & Decker Mfg. Co.*

Circle No. 48

Piercing units

Piercing units, for use in air press made by manufacturer, can perforate tubing, pipe, moulding, flat stock, angle iron, channel, etc. Punch and die assemblies can be furnished for round, slot, oval, square or other openings. Unit can pierce a ¾-in. diameter hole in 11-gage steel or 1-in. diameter hole in 14-gage steel and can perforate tubing up to 1⅝-in. OD. *Vogel Tool & Die Corp.*

Circle No. 49

Circle No. 198 on Reader Service Card

NEW RODS
NEW LOW PRICES
NEW "CRACK-CHECK" CHROME-COPPER MOLY Fuse-Well No. 31 Rods

• NICKEL-MOLY Hi-Strength Fuse-Well No. 14 Rods

WRITE FOR SAMPLES, NEW LOW PRICES TODAY!

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CHICAGO HARDWARE FOUNDRY CO.
North Chicago, Illinois

FUSE WELL

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MANUFACTURERS & DISTRIBUTORS OF ACETYLENE GAS!

When your truck pulls away from the loading dock your trucking costs per cubic foot of gas depend on how much GAS is in the load — not how many cylinders. If the gas YOU sell is in COYNE CYLINDERS with the higher porosity filler, then you are selling and delivering up to 30% MORE GAS ON EVERY TRUCK, and decreasing trucking cost by 30%.

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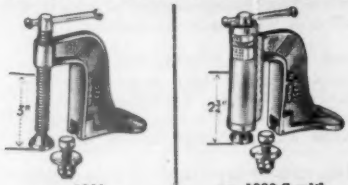
Circle No. 200 on Reader Service Card

TRADE MARK
"Jorgensen"
REG U S PAT OFF

HOLD-DOWN CLAMPS



no. 1623 without shield | no. 1623-S with shielded screw

NOW with shielded screw for welding service.

Can be spotted on any work-surface (wood or metal), drill press or "T"-slot table. Ideal for temporary or permanent production set-ups.

Clamp slips "on" and "off" pre-spotted holding-bolt in seconds. It's there when needed, out of the way when not in use. Functions equally well in the middle or near the edge of work area. Doubles as vise along side of bench.

Patented "Jorgensen" steel shield POSITIVELY protects screw against welding "spatter" or other damage.

SOLD THRU DISTRIBUTORS —

Write for details on complete line — "Jorgensen" and "Pony" clamps.

ADJUSTABLE CLAMP CO.
"The Clamp Folks"
428 N. Ashland Ave. Chicago 22, Ill.

Who said: "Un-weldable?"

Before you call it "un-weldable" check it out on the NRC Electron Beam Welder. Problems posed by reactive metals, dissimilar materials, heat sensitivity, and unusual geometry are being solved daily.

•Tungsten, tantalum, columbium, zirconium, etc. are welded free of contamination and porosity • Finish machined parts are joined without distortion • Sensitive instruments are evacuated and sealed • Precision welds are made at the bottom of a 1/16" slot or between two surfaces meeting at an acute angle • Depth/width ratios greater than 4/1 are attained.

Try NRC E/B Welding . . . a special Small Lot Welding Service is available at hourly rates, or you can get a complete E/B installation for less than $16,000! Call or write now.

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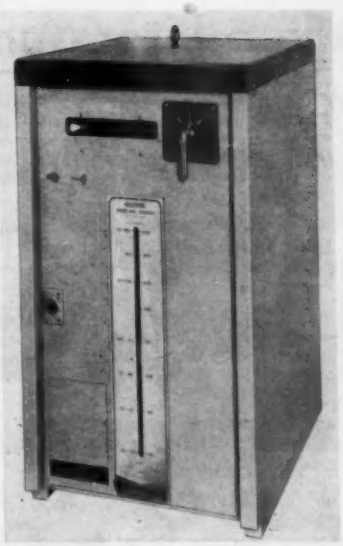

Power supply

Power supply is designed for Tig welding. Circuit design provides capacitor bank in secondary circuit and nonsaturable reactor and transformer design to assure balanced electron flow between electrode and workpiece. Full electron flow in both directions improves surface oxide removal in aluminum welding, reduces arc fluctuation, spatter. Infinitely-variable motorized current control provided throughout overlapping switch ranges of low, 28 to 58 amp; medium, 53 to 175 amp; high, 165 to 400 amp on 150-volt scale. BW400-AC delivers a-c only with open circuit voltages of 100 and 150. BW400-AC/DC includes rectifier bank and delivers a-c or d-c with 150-volt open circuit on a-c and 80-volt on d-c. *Glenn Pacific Corp.*

Circle No. 50

Nickel-silver alloy

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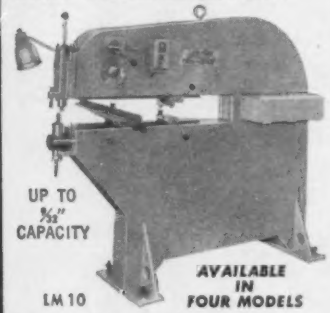

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92. BED, FLOOR PLATES—Acorn Iron & Supply Co. Brochure describes heavy bed plates and floor plates which can be floor-bolted, embedded in concrete or mounted on stands.

93. OPEN MOTORS — Allis-Chalmers Mfg. Co. Bulletin 05-51B9040B is 12-page illustrated guide to open-motor line.

94. BRAZING ALLOY — Wall Colmonoy Corp. Two-page engineering data sheet (No. 2.1.4) describes brazing alloy and lists recommended uses with illustrated case history.

95. HYDRAULIC POWER UNITS — Hannifin Co. Six-page Bulletin 0980-B1 catalogs 37 new hydraulic power units.

96. TEMPLATE KIT — Jergens Tool Specialty Co. Complete kit of full-size tracing templates for jig and fixture components can be used as overlays for correct location of components on drawings and to check fit.

97. WELDING CONNECTIONS — Western Enterprises, Inc. 20-page illustrated catalog in color lists welding connections, prices and specifications.

98. DIAL TIMERS — Automatic Timing & Controls, Inc. Bulletin No. N-309, 4 pages, describes series of push-button automatic-reset-dial timers.

99. PLANT SAFETY — The North American Mfg. Co. 12-page, color, illustrated Supplemental Bulletin 22 explains safety system for plants using gas and fuel oil.

100. WELDING WIRE — Page Steel and Wire Division. Four-page form (DH-1218R) is comparison chart of firm's welding wire.

101. CO-2 FIRE EQUIPMENT — Cardox Division. Booklet (Form 163) describes fast-acting and economical fire extinguishment for the metalworking industry.

102. BUS DUCT—Westinghouse Electric Corp. 12-page booklet gives application data for high-frequency bus duct of the electrical power supply required by resistance welders.

103. STANDARD STEEL SPECIFICATIONS — American Institute of Steel Construction, Inc. "Specification and Loading Tables for Open Web Steel Joists" and "Specification for Architecturally Exposed Structural Steel" give necessary information in concise form.

104. GAS-CUTTING MACHINES — Messer Cutting Machines, Inc. Illustrated 11-page article deals with heavy-duty gas-cutting machines.

105. TUBING — Babcock & Wilcox Co. Illustrated Bulletin T-456 presents information on the use of tubing for corrosion resistant service or elevated temperature and/or pressure service with ASTM tubing and pipe specification list.

106. FURNACE ANALYZER — Thermco Instrument Corp. Bulletin 103-60 gives specifications and information with illustrations of furnace analyzers.

107. ARC WELDING — Hobart Bros. Co. AWN-165 is a 24-page booklet of interesting photographs and articles from all over the country on welding.

108. TRUCK LIFTING CYLINDERS — Ampco Metal, Inc. Ampco Welding News, 3rd quarter, 1960 discusses building wear into telescoping cylinders of truck lifts and platform-type dumpers.

109. GIRTH WELDING — Morton Mfg. Co. Bulletin No. 43R is illustrated 4-page description of various girth welding machines.

110. SPOT WELDING STEELS — The Taylor Winfield Corp. Bulletin Sp-6A is 8-page brochure describing equipment and procedures recommended for spot welding hardenable steels.

111. PORTABLE TOOLS — Buckeye Tools Corp. Every portable air-powered and electric tool made by firm is covered in 72-page Catalog No. 61.

112. RUST REMOVER — Oakite Products, Inc. Service Bulletin No. 16B gives tested and proved procedures for preventing and removing rust under almost any conditions.

113. MAINTENANCE, REPAIR PARTS — LaSalle Steel Co. Bulletin 24, 16 pages, presents helpful facts about making maintenance and repair parts.

114. BAND SAWS — Wells Mfg. Corp. Bulletin 230 and Bulletin 262-A give information on two models of compact metal cutting band saws.

115. ARCHITECTURAL METALS — Tennessee Fabricating Co. Fully illustrated 20-page catalog (No. 1970.0) gives complete information on wide variety of cast iron, cast aluminum, extruded aluminum and wrought iron architectural metals.

116. GROUNDING VESSELS — Aronson Machine Co., Inc. Grounding vessels on turning rolls for welding is subject of 1-page bulletin.

117. ABRASIVE BELT MACHINES — The Carborundum Co. Four-page illustrated brochure sets forth specifications and advantages of series of abrasive belt machines for woodworking and metalworking.

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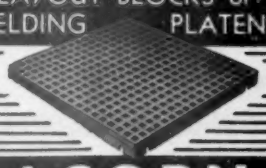

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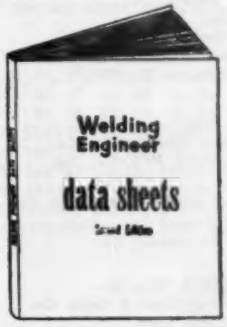

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118. FOIL WELDING — Air Reduction Sales Co. Article provides complete information on the control of process variables for successful foil welding.

119. BLAST CLEANING — Wheelabrator Corp. Wheelabrator Tips, Vol. 7, No. 2, contains an article on accurate testing of blast patterns.

120. ELECTRON BEAM WELDER — High Vacuum Equipment Corp. Four-page bulletin in color illustrates Beamatron welder and gives its features, cost advantages, applications, theory and other data.

121. CORROSION-RESISTANT ALLOYS — Ampco Metal, Inc. 20-page two-color bulletin gives specifications of nine special wear and corrosion resistant alloys.

122. WIRE FEED WELDING — Hobart Bros. Co. four-page folder (J-10854) illustrates and gives applications for firm's small-wire automatic wire feed welding process.

123. SOLDERING FLUXES — Kester Solder Co. eight-page brochure (Form 332-Rev. 4-58-10M) gives full information on variety of soldering fluxes.

124. INERT GAS WELDER — Birdsell Mfg. Co., Inc. two-color tear sheet (Form AC/DC 1) gives features and specifications of firm's rectifier-type combination a-c/d-c inert gas welder.

125. IRON BENDER — Hossfeld Mfg. Co. four-page two-color folder (Form 588) lists and illustrates iron benders with specifications.

126. FACE SHIELDS — Kedman Co. two-color sheet illustrates firm's face shields with specifications.

127. CRYOGENICS — American Messer Corp. four-page brochure in color defines cryogenics and lists its advantages.

128. INDUCTION BRAZING — Tocco Div. Catalog 22 Section E, 12 pages, illustrates and gives various results of induction brazing and soldering.

129. WATER FILTRATION — Rosean Co. illustrated case study shows how filter increases resistance welder electrode life.

130. WELDING ABRASIVES — Carborundum Co. Form No. A-1483, 12 pages, NWSA Index 1010, illustrates and gives specifications of firm's welding abrasives.

132. RESISTANCE WELDERS — Thomson Electric Welder Co. four-page two-color form (6-00-21) explains firm's synchro-matic welders with illustrations.

133. WELDING PLASTICS — Laramy Products Co. two-color sheet illustrates and gives specifications of utility torch for welding plastics.

134. X-RAY PROCESSING — Eastman Kodak Co. Wall Chart M4-26 provides a concise, comprehensive guide to recommend X-ray film tank processing procedures.

135. CONVERSION FACTORS — Precision Equipment Co. Wall chart contains many conversions difficult to locate in reference manuals.

136. TUBING — Babcock & Wilcox Co. Eight-page illustrated Bulletin T-459, gives information on electric-resistance-welded carbon steel mechanical tubing.

137. WORK GLOVES — The Granet Corp. Eight-page illustrated booklet in full color gives full information on coated-fabric work gloves with chemical resistance chart.

138. CHAIN SAFETY — The McKay Co. Sling chain safety kit (10M59) includes useful hints on chain safety, inspection and attachment.

139. ABRASIVE CUTTER — Allison-Campbell Div. Four-page form (DH-299-A) in color illustrates and gives specifications of dry abrasive cutting machine (Model 2-A).

140. CORE SOLDER — Kester Solder Co. Four-page Form No. F 374 includes a solder chart of common alloys and temperatures at which they become plastic and liquified.

141. STEEL SHEET STORAGE — Raymond Corp. User's Report No. 27 show's how firm handled a sheet metal handling problem.

142. STRESS ANALYZER — Mitchell Radiation Products Corp. Form (2100) describes and illustrates portable x-ray stress analyzer.

143. METAL POWDERS — Federal-Mogul Div. Four-page full-color brochure describes pre-alloyed and elemental atomized metal powders for high temperature brazing and low temperature soldering.

144. TOGGLE CLAMPS — Detroit Stamping Co. 36-page Catalog 77 features firm's complete line of toggle clamps.

145. WELDING HELMETS — Flood Safety Products Co. Bulletin No. 21, four pages, illustrates and gives specifications of firm's welding helmets.

146. MOLECULAR BONDING — Al-Fin Corp. 12-page brochure illustrates and gives full information including technical data on molecular bonding process.

147. SAFETY SHOES — Record Industrial Co. Color folder (8M1060) describes and illustrates line of lightweight safety shoes.

148. GRINDING WHEELS — Simonds Abrasive Co. Four-page form (No. ESA-244) includes action photos and specifications of firm's depressed center wheels for weld grinding.

149. CUTTING MACHINES — Linde Co. Form 1396, 28 pages in color, describes flame-cutting machines.

150. ARC WELDING — The Taylor-Winfield Corp. Bulletin 8-513-A, eight pages in color with photographs, presents information on automatic arc-welding machines for mass production.

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Advertisers' Literature

Literature offered in advertisements which were received up to the 5th of last month. To get the literature you want circle numbers on Reader Service Card on this page.

190. All-State Welding Alloys Co., Inc.— Instruction Manual available on "Spoolarc" and other All-State products for welding.

175. Bausch & Lomb, Inc. — Catalog available on goggles for eye protection with interchangeable parts.

154. Bernard Welding Equipment Co. — Form SS600 gives further information on the model 600 "Shortstub" electrode holder.

155. Bridgeport Brass Co. — Bronze welding booklet available on Bridgeport welding rods.

193. Coast Metals, Inc. — Loose leaf binder contains latest information and technical data on the Coast Metals line of arc and gas welding rods, automatic wire and castings for critical parts.

197. Galv-Weld Products — Write for information and sample of galvanizing manufactured by Galv-Weld.

153. Glenn Pacific Power Supply Corp. — Literature and specifications on the new "Glenn Variable Slope" constant voltage power supplies is available.

157. Goldsmith Brothers — Full particulars on silver brazing alloys and GB #88 flux is contained in the GB Silver Brazing Data Book.

160. Handy & Harman—Write for "Training Course Prospectus" to give you more information on the new silver alloy brazing correspondence course offered by Handy & Harman.

168. Harnischfeger Corp. — Booklet R-29 offers further information on "P&H 17OLA" all position electrodes.

151. Hobart Brothers Co. — Bulletin DM-159 gives further information on "Microwire" welding package, which feeds wire automatically for all position welding.

172. Liquid Carbonic Div. of General Dynamics — Welding and cutting appartus catalog available.

189. Lucas-Milhaupt Engineering Co. — Write for 16 page booklet on better brazing.

176. Merrill Brothers — Catalog C-3 available describing Merrill horizontal plate clamps and other material handling devices.

187. No-Arc Equipment Co. — Bulletin W-3 available on the No-Arc electric welding gun.

159. Page Steel and Wire Div. — A new welding wire comparison chart is available and a pocket size color code identification card.

158. Rankin Mfg. Co.—Bulletin No. R101 is available on the new "Ranomatic" wire for automatic and semi-automatic hardfacing.

180. Riegel Textile Corp.—Catalog available on Riegel gloves for weldors.

196. Singer Glove Mfg. Co. — New catalog available on Singer screens, work gloves, welding gloves and safety clothing.

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WARNING!

Illegible or incomplete addresses may keep you from receiving the information you desire. And remember, cards postmarked after the deadline date cannot be processed.

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adds pot of gold to piping "rainbows"

One way to profit from complex piping designs for petrochemical plants is to bank on the efficiency of Tungsten Inert Gas Welding. Whether it's piping, railroad cars, bridges or hardware for outer space, you'll find TIG welding means many benefits. Particularly if you select Sylvania Tungsten Electrodes.

Sylvania offers the most complete line of top-quality Tungsten Electrodes: Puretung®, Zirtung®, 1% Thoriated, 2% Thoriated. Each comes in the preferred finish—cleaned or ground, and color-coded to save you time and prevent costly errors. Chemical & Metallurgical Division, Sylvania Electric Products Inc., Towanda, Pennsylvania.

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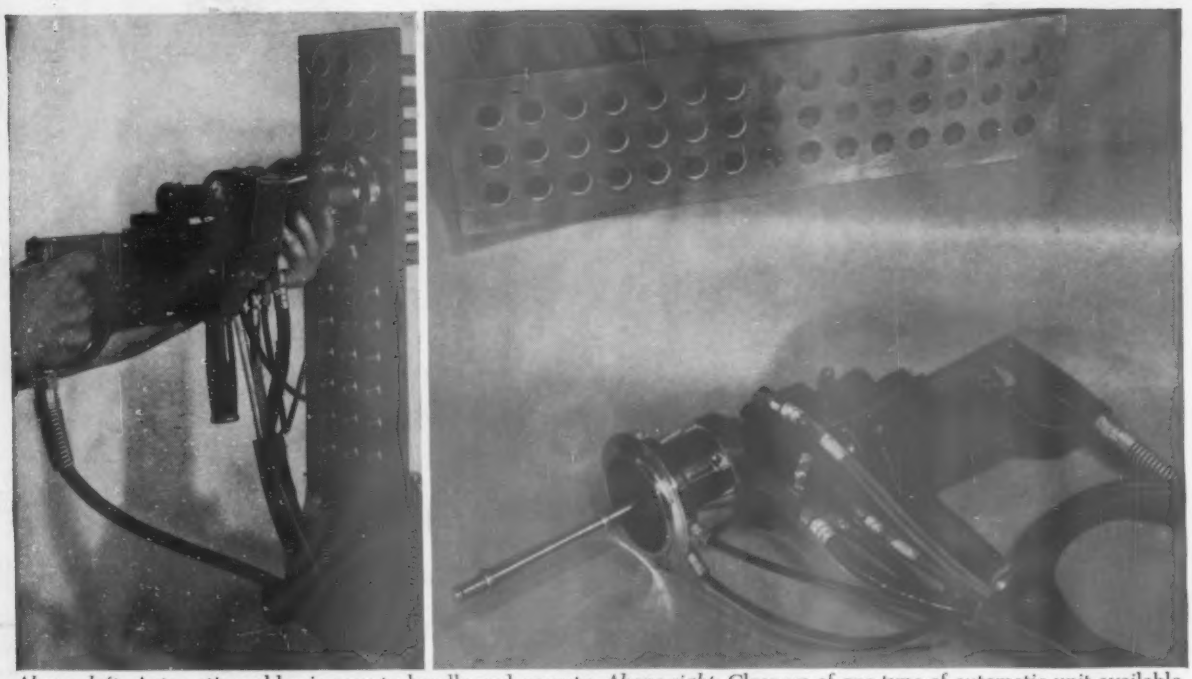


Above, left: Automatic welder is easy to handle and operate. *Above right:* Close-up of one type of automatic unit available for welding tubes to tube sheets. Note uniformity of sample welds above.

Mechanized welding process makes the permanently tight heat exchanger tube joints needed in modern power plants

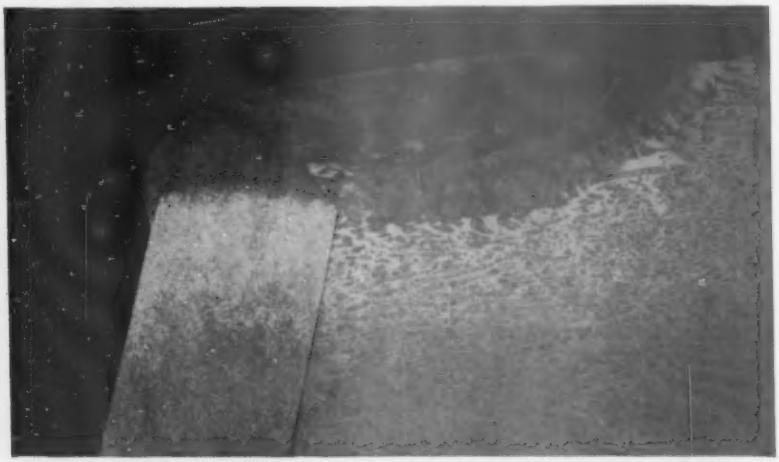
The design and operation of modern steam power plants require that tubes in condensers and feed-water heaters be installed permanently tight to prevent contamination of the boiler water.

Welding the tubes to the tube sheets will insure this. In most cases, however, welding cannot be done manually for a variety of reasons. A mechanized process must be employed to produce consistently high quality joints.

Inert-gas tungsten-arc (TIG) welding has the advantages of simplicity, good control, and protective shielding without the use of flux. Tough, dependable equipment for automatic welding with this process—such as that shown in the illustrations above—is widely available. These units make it possible to weld, without the complication of filler-metal addition, most of the tube and tube sheet combinations employed in condensers and heat exchangers.

Joints, whether a few hundred or several thousand in number, are uniform in geometry and quality. Typical are the results obtained with tubes of Arsenical Admiralty-439 on tube sheets of Naval Brass-450, as shown in the 20X micrograph reproduced at the left, below.

Technical Assistance: The Metallurgical Department of Anaconda American Brass Co. will gladly help you in the selection of suitable alloys and in welding procedures and the design of joints. This service is available without obligation. See your Anaconda representative or write: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 6092L



Micrograph 20X of typical weld section. Tube is of Arsenical Admiralty-439 and tube sheet is of Naval Brass-450.

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